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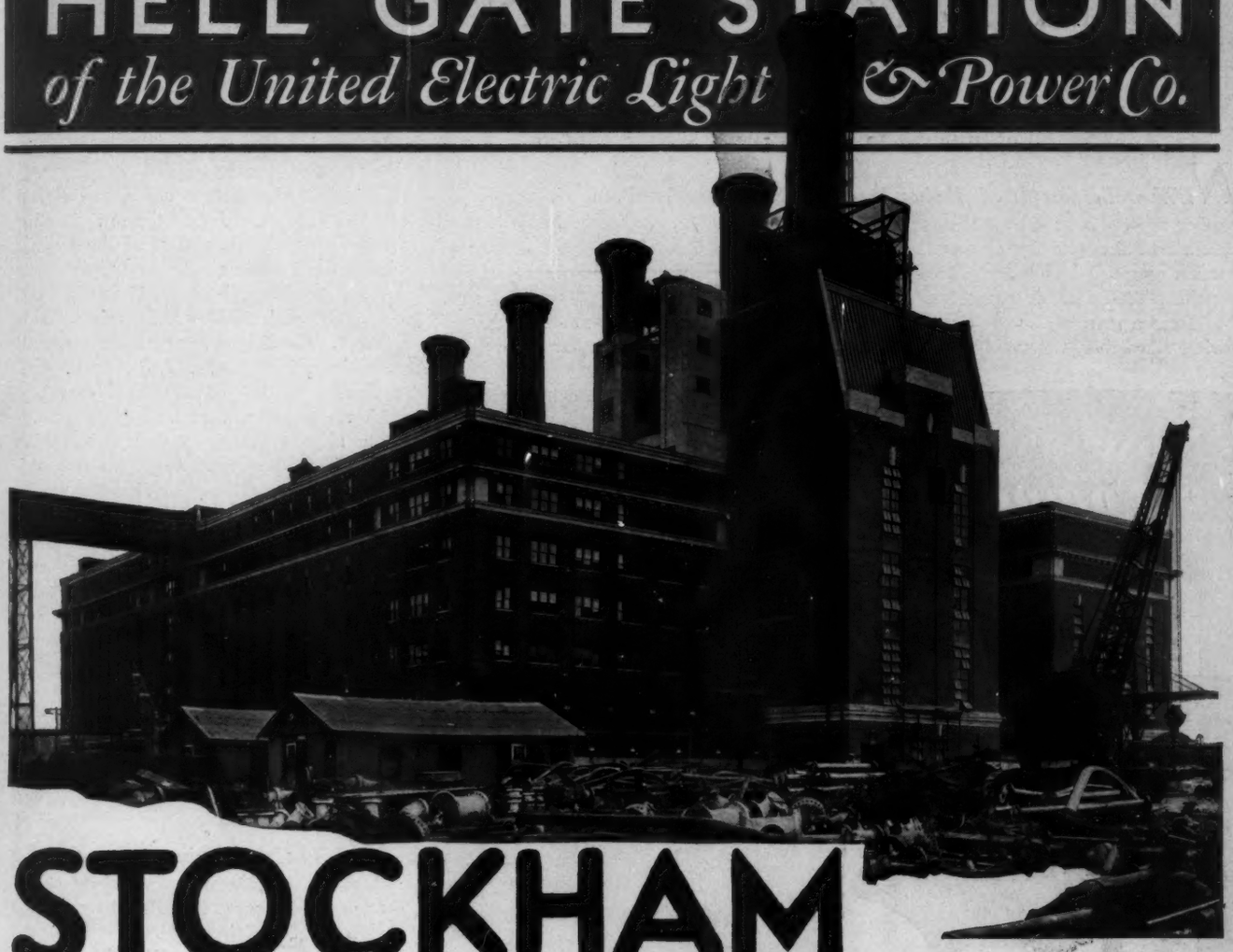

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THE MONTH IN REVIEW

In the following columns will be found a brief digest of happenings of interest to refiners, with even reference to a rumor or two!

NEW wells completed during December showed a gain over the preceding month and the quantity of new oil production obtained had the effect of boosting the potential crude supply. Although there was a gain of 226 well completions during December, the number of producing wells completed only increased six over November. Large wells in several flush areas resulted in a gain in new oil production during the month of more than 78,000 barrels; increasing from 901,046 barrels in November to 979,111 barrels in December. Of particular significance is the fact that actual crude production for December receded to the lowest point of the year. Crude output of the United States during the month is estimated to have aggregated about 67,811,550 barrels, compared with 68,639,150 barrels in November. The daily average for the month is estimated at about 2,187,450 barrels, against 2,288,000 barrels in November. This represents a decline of slightly more than 100,000 barrels a day. All major producing areas contributed to this decline, with Texas showing the largest decline. Texas, outside of the Gulf Coast, succeeded in reducing the daily average crude production of its fields about 44,400 barrels daily, reflecting the stringent measures of curtailment that were put into effect in the state toward the close of the year. Oklahoma continued to reflect curtailment during December when the daily average crude production of that state receded from 491,550 barrels in November to 460,600 barrels, a decline of 30,950 barrels.

DRILLING during December resulted in the completion of 1479 wells, of which 650 were oil wells, 310 were gas wells, and 519 failures. This represented a gain of 226 total wells; six new oil wells; 93 gas wells and 127 failures. The average initial oil production per well during December was 1506 barrels, compared with approximately 1400 barrels per well in November. Initial production per well for the year 1930 averaged 932 barrels, against 488 barrels during 1929. This shows how potentials were augmented during the past year, as a direct result of developments in the new flush areas of Oklahoma, California and Texas. Increased well completions were reported by the Eastern States, California, Oklahoma, Kansas, Arkansas and Texas. Texas reported a gain of about 100 new well completions, while the Eastern States reported a combined gain of 115 well completions.

Initial oil production was boosted materially in Oklahoma, showing a gain during December of more than 200,000 barrels. This was all due to a sharp gain in new production of the Oklahoma City field where initial output rose from 346,001 barrels in November to 562,593 barrels in December. California reported a gain of nearly 7000 barrels in new oil production during December; Kansas, a gain of nearly 6000 barrels; Texas, a gain of 45,000 barrels. New operations in the Lea

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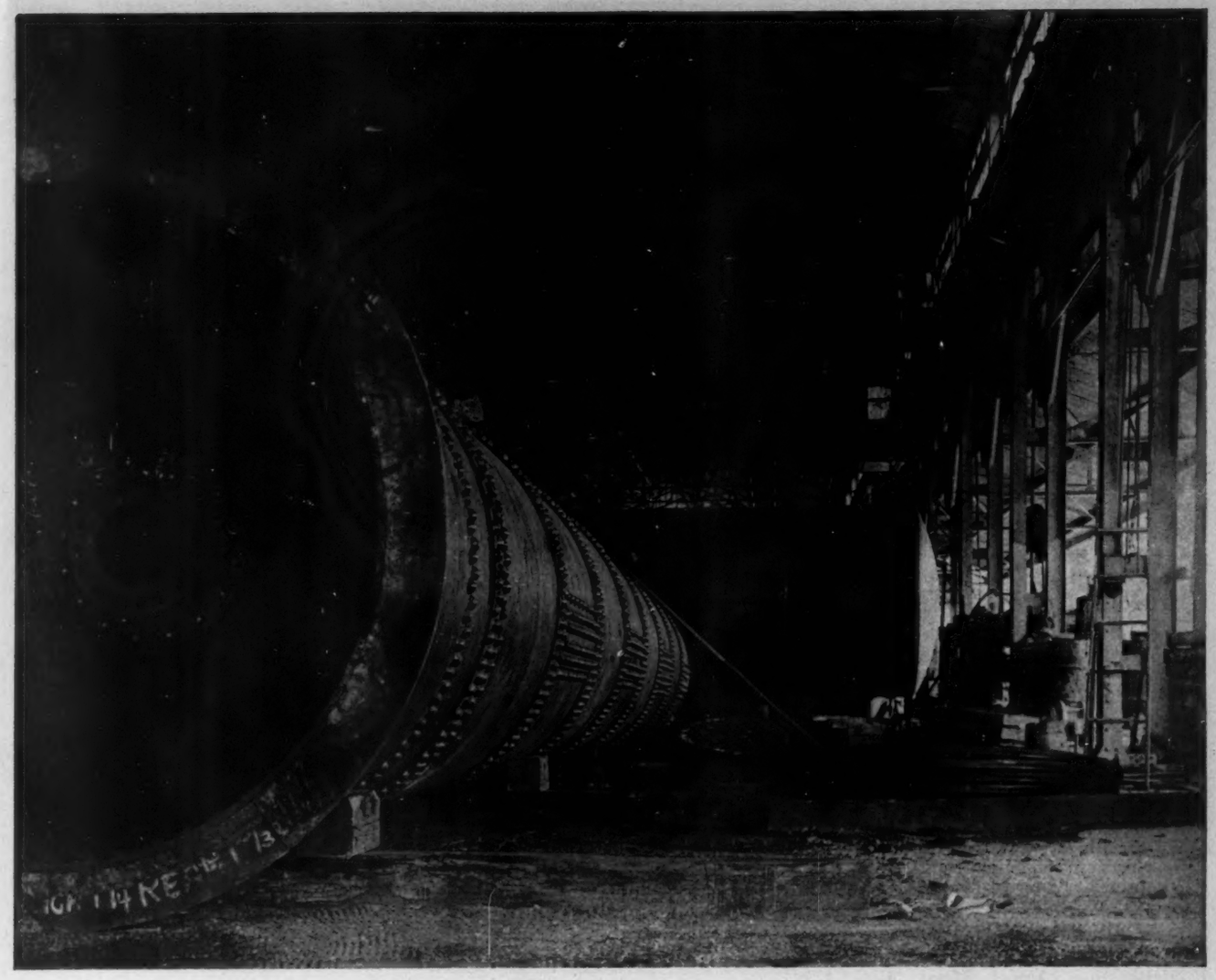

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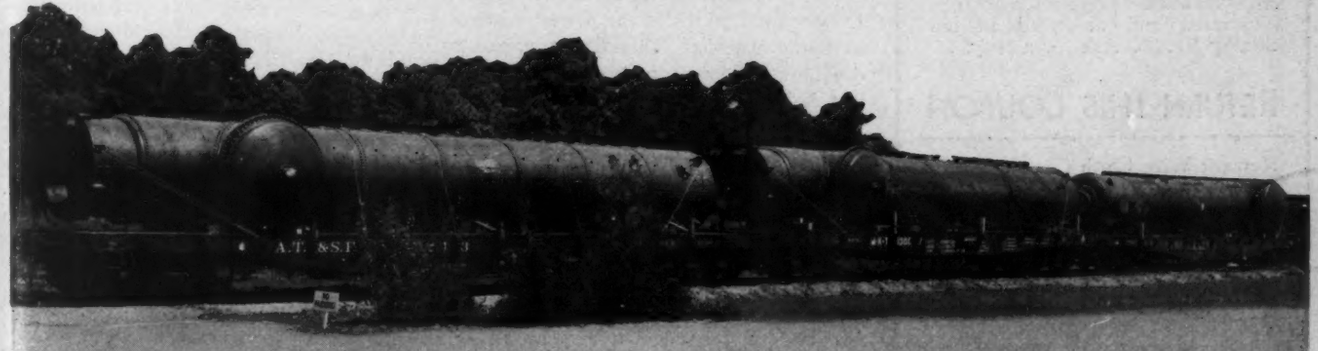

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THE MONTH IN REVIEW

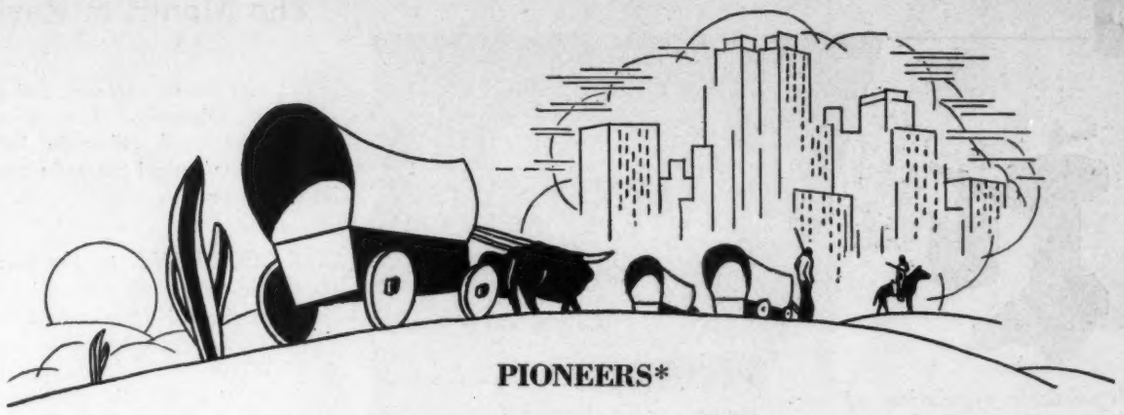
County, New Mexico, area resulted in a sharp decline in new oil production, from 171,395 barrels in November to only 88,398 barrels in December. Louisiana also reported a decline in new oil production of about 11,000 barrels. Eastern States contributed to the increase in initial oil output to the extent of about 4000 barrels.

GASOLINE stocks at refineries on January 3 were reported by the American Petroleum Institute at 39,388,000 barrels, an increase for the week of 400,000 barrels, despite a decrease in runs of crude in the same period of 121,000 barrels per day. An explanation may lie in the withholding of shipping instructions during the holidays to keep buyers' inventories low, or it may be that the period of low consumption is in such force that efforts to maintain stocks of refined oils at low levels must be redoubled if the goal of 45,000,000 barrels of gasoline at refineries on April 1 is to be accomplished. Entering the new year with stocks five million barrels below the quota set for the beginning of spring demand is an encouragement only in that it points to the possibility of the desired end in case charging schedules are kept strictly adjusted to shipments. Many important refining units claim that their production is held to minimum requirements. Currently runs to stills are about 634,000 barrels daily below the peak of April last year; production of crude in December was 450,000 barrels under April of last year.

CRUDE oil production in the United States has so responded to efforts to curtailment that the daily average for the week ending January 3 had been brought down to 2,080,100 barrels (A. P. I. estimate), which is the lowest reached in many months. This figure means a draft on stocks as refineries during the last half of December were running in excess of 2,200,000 barrels per day, according to data compiled by the Institute. The producers' outlook, therefore, is brighter as the new year starts, but their plight has been such that any change would be for the better. The danger in the situation as exists is that there will be relaxation of the forces which are holding back a large potential flow of oil from wells whose owners are anxious for profits which they see immediately in opening the valves. Crude still is in such supply that there is no strength to the market and reduction of stocks can well continue for a period without any enthusiastic competition for oil on the part of purchasers.

PRAIRIE Oil & Gas Company created the big furor in petroleum circles during December by announcing that it would withdraw as a purchaser in the settled areas of Eastern Kansas and Oklahoma on January 1. The company announced that it was withdrawing as a purchaser because of loss of its markets which had been taking that oil, and came in for much criticism at the hands of producers, civic and governmental bodies, and even other buyers and transporters of crude oil. Insistant demands made of all purchasers in the two states that something be done to relieve the situation—closing in of the wells and danger of water intrusion in several thousand stripper wells—precipitated such criticism of Prairie Oil & Gas Company that the company issued a statement detailing its reasons for stopping its purchases; putting its lines at the disposal of other buyers who might wish to enter the area. Briefly, it was set out in the statement, erstwhile customers of Prairie Oil & Gas Company have built their own pipe lines and are running their own crude. Long dominant in the Mid-Continent, the company has served Great Lakes and Eastern units of the Standard Oil group. Late developments, involving a long story, have pushed Prairie out of the group; the Ajax Stanolind and Texas-Empire lines are serving its customers. Long involved in rumors of consolidation with Sinclair interests, announcement that that deal was off came just when all the dope had it set for consummation. In the end the company finds itself with an excellent system of pipe lines, substantial actual and potential production, large stocks of oil, greatly restricted demand for its crude and its services. Units it once served, now competitors, joined in the criticism of cutting off purchases, suggesting that it continue as a benefit to the industry; and hundreds of producers who in other years have been much served have forgotten past favors. Early in January the company announced that it was looking for an outlet for its crude, might build or acquire a refinery. (The company holds stock interest in Producers & Refiners Corporation, plants at Parco, Wyoming, and Tulsa).

Agitation over the plight of the small producers in Kansas and Oklahoma resulted in the governors of those two states issuing a joint call for a meeting of committees appointed by the governors of all oil producing states to meet at Washington on January 15 to consider the plight of the industry. A renewal of demands for an oil tariff is in prospect. Secretary of the Interior Wilbur, close



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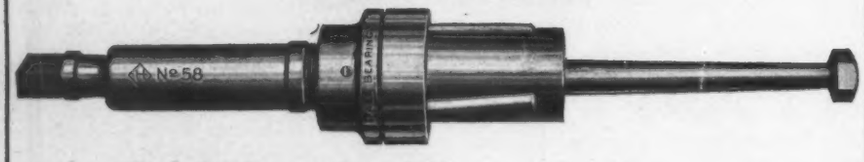

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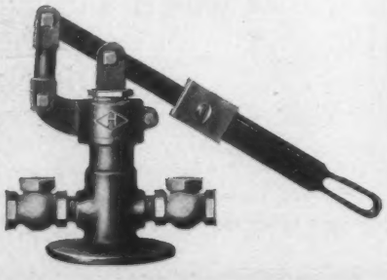

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The Month in Review

friend of President Hoover and probably speaking advisedly, has pronounced against the tariff, citing the balance in favor of the United States in export and import movement.

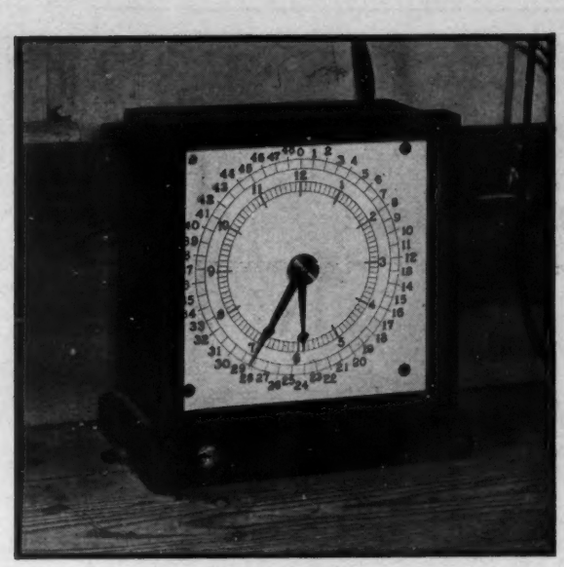
ACCORDING to the Bureau of the Census, the total value of petroleum products shipped from refineries in the United States during 1929 aggregated $2,597,370,104. This figure represents an increase over 1927, the previous census, of 21.7 per cent, during which year the total value represented $2,133,922,688.

Details of products and their value for the year 1929 are in part as follows: 17,982,832,107 gallons of gasoline and naphtha, valued at $1,579,082,717; 216,-226,775 gallons of other light products of distillation, $13,898,196; 2,332,437,794 gallons of illuminating oils, $164,009,087; 16,-134,961,225 gallons of fuel oils, $379,682,-995; 1,423,414,222 gallons of partially refined oils sold for rerunning, $48,435,537; 1,546,000,126 gallons of lubricating oils, $301,922,011; other products and by-products of refining, $110,339,561.

CONTINENTAL Oil Company officially dedicated its new refinery at Denver, Colorado, New Years day. The company had 55,000 barrels of crude in storage from which it planned to run 1500 barrels per day. Railroad switches are completed. Most of the crude stored at the plant has come from Fort Collins field, with the remainder coming from the discovery well of the Platte Valley Petroleum Corporation in Weld County. The new refinery will operate to supply needs of Continental Oil Company in the Colorado and adjacent area.

ATTORNEY General L. A. Foote of Montana, has again proposed that the state refine its own royalty oil and he plans to submit the idea to the state legislature this month. Attorney General Foote states that bids for the state's share of crude production on public lands indicate that the state is not receiving a proper return and he suggest that a refinery be established at the state prison, thereby aiding in the solution of the unemployment problem there. The fuel manufactured, he states, could be furnished the several state institutions and the by-products could be utilized by the state highway department.

RECENT changes in Skelly Oil Company official personnel effected the



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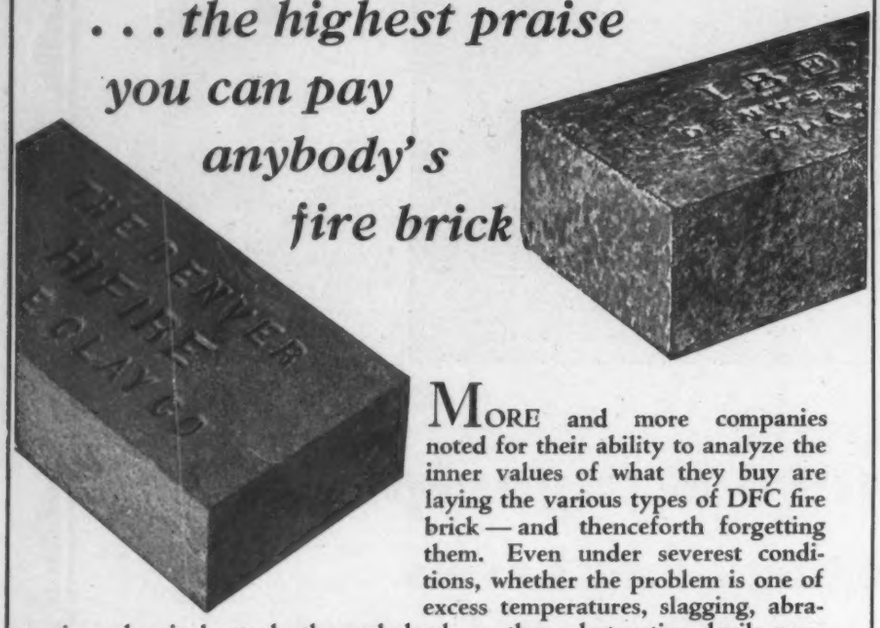

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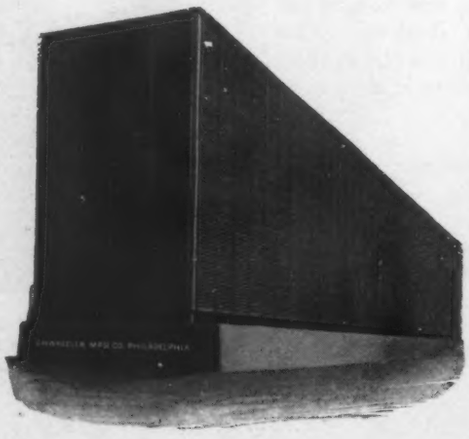


The Month in Review

appointment of Emby Kaye as manager of a newly created manufacturing division. Mr. Kaye has for several years been general superintendent of the natural gasoline department of the Skelly Oil Company. The new division includes the refinery and compounding operations of the company as well as the manufacture of natural gasoline, which becomes a part of the new division. Mr. Kaye is well known to the refining and natural gasoline fraternity. He joined Skelly Oil Company just after the late war and while in charge of operations has developed the division until it is now one of the major manufacturers of natural gasoline and other natural gas products. He will continue to have his offices at the Tulsa headquarters of the company.

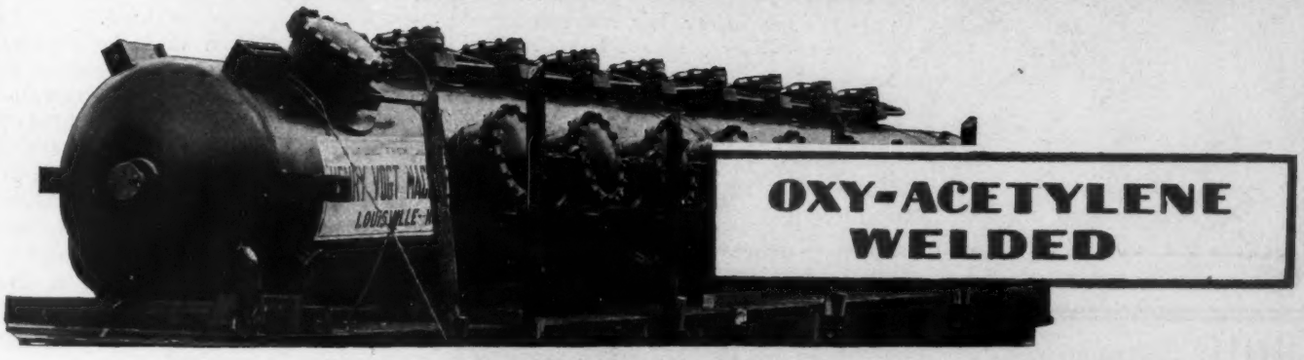
SWAIN Oil Company of Blackwell, Oklahoma, operating in the fields of Western Kansas, has under advisement a plan for the erection of a new oil refinery to be located as conveniently as possible to a large area in the western part of the state. If the reported plans are carried through the refinery will be erected some time in the early spring.

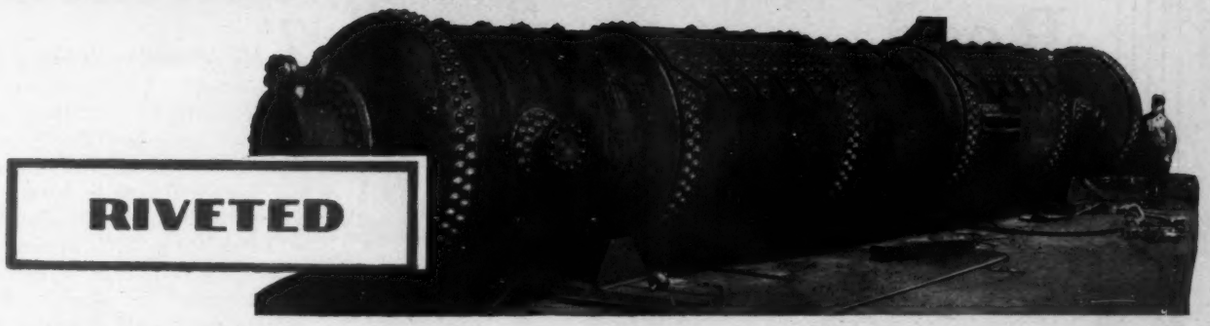
CONSTRUCTION work at the Broadway refinery, Cleveland, Ohio, of Standard Oil Company of Ohio, involves the dismantling of an old pressure still battery to provide space for the installation of an asphalt plant. The cost of this project is reported at $175,000. In addition extensive remodeling of some of the present tube and tank cracking units is planned. A new locker or change room for employes is to be erected. The company has recently completed a construction program involving improvements at both of its Cleveland plants, at the Toledo plant and at the Latonia plant of the Latonia Refining Company, subsidiary, which involved the expenditure of about $2,500,000.

STUDY of the proposed specifications for motor fuels of the Federal Specifications Board as they affect state gasoline standards will be made in the early future by a committee representing the Board of Directors of the American Petroleum Institute.

R. C. Holmes, The Texas Company, New York, is chairman of the committee, which was appointed by President Reeser at a session of the directors during the eleventh annual meeting of the Institute at Chicago early in November. Members are: W. M. Irish,

3 METHODS





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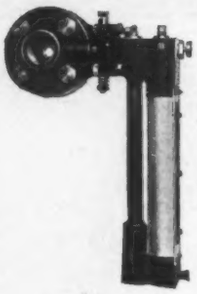

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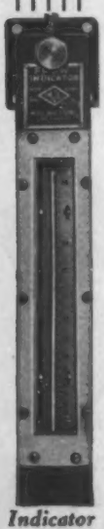

Indicator Body

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MOREY & JONES, LTD.

Manufacturing Engineers
925 Hemlock Street
Los Angeles California

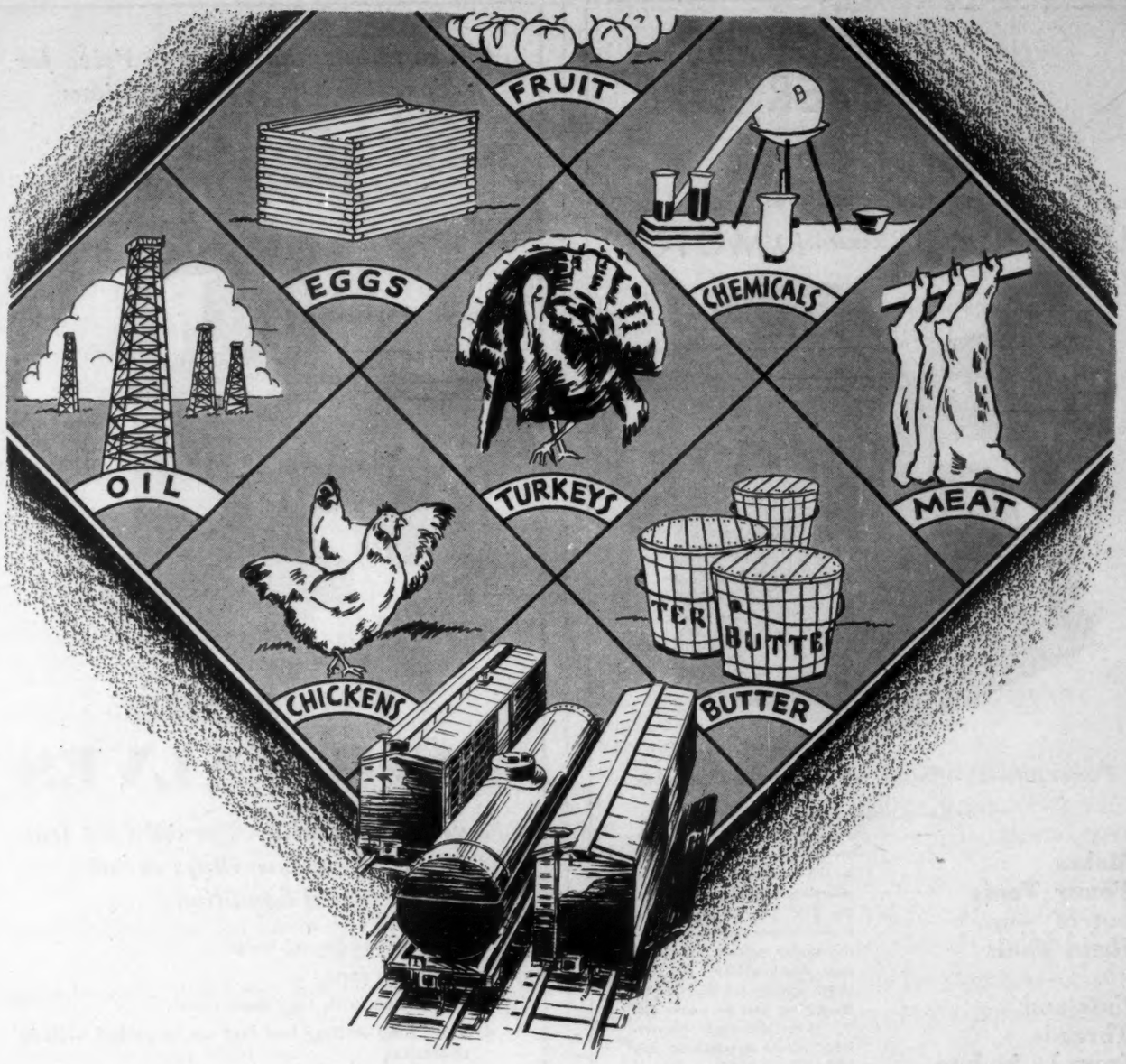
The Month in Review

The Atlantic Refining Company, Philadelphia; J. Howard Pew, Sun Oil Company, Philadelphia; George R. Nutty, Gulf Refining Company, Pittsburgh; K. R. Kingsbury, Standard Oil Company of California, San Francisco; and W. G. Skelly, Skelly Oil Company, Tulsa. The committee will work in conjunction with the Institute's Division of Refining Committee on Testing Methods and Specifications.

Appointment of the committee was authorized after the directors had received and discussed a resolution adopted by the Western Petroleum Refiners Association, with affirmative recommendations by the General Committee of the Institute's Division of Refining, stressing the immediate need of studying the provisions of specifications, both federal and state, as they affect gasoline sold for general use.

It was explained that the Federal Specifications Board, in proposing to modify specifications for U. S. Government Motor Gasoline, had established as a protection against vapor lock a maximum vapor pressure requirement of 10 pounds per square inch. This is regarded by refiners as placing an undesirable restriction on the volatility of gasoline that may be sold to the public in the many states which have adopted U. S. Government Motor Gasoline as their standard.

THE Atlantic Refining Company is reported to have paid a million dollars to Mills Bennett Interests for six miles of pipe line from the Barbers Hill field, Texas Gulf Coast, barges and tugs sufficient to handle the capacity of the line, a refinery and terminals at Texas City. It is reported that the refinery will not be operated by the new owners. The plant is rated at 4000 barrels daily, half of which is Jenkins. The Atlantic Refining Company, operating in Texas as Atlantic Oil Producing Company and Atlantic Pipe Line Company, operates a terminal near Beaumont, where its line across Texas from New Mexico terminates. The terminal acquired at Texas City becomes available for handling oil from Barbers Hill by barges and from other Texas Coast fields by rail. Humble Pipe Line Company has the only pipe line to Texas City. Atlantic recently contracted for 4,000,000 barrels of Southwest Texas oil to move from Port Aransas at the rate of 12,000 per day. Delivery is to be made by Gulf Coast Pipe Line Company (Moody-Seagraves) from the Refugio and Pettus fields.



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VOL. 10, No. 1

JANUARY, 1931

GRADY TRIPLETT, *Editor*

GEORGE REID, *Associate Editor*

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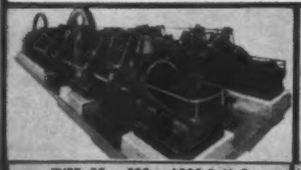
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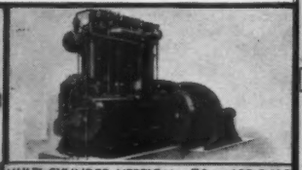
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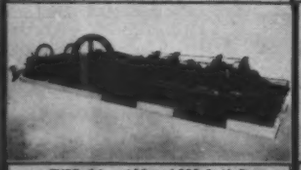
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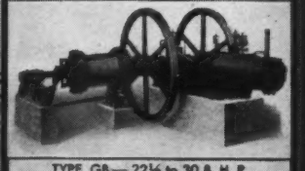
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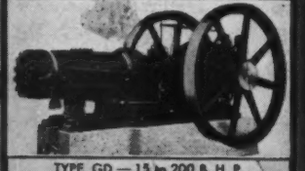
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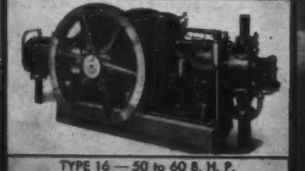
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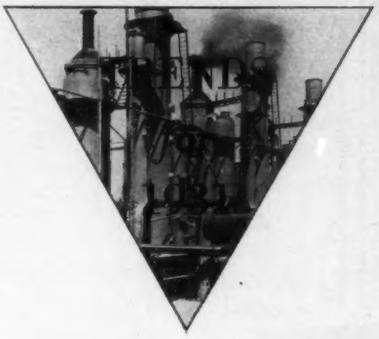


THE changing industrial picture is ever bringing about influences which affect not only the equipment, methods and processes upon which production depends but which contribute to a major extent the expenditures of industry necessitated by ever approaching obsolescence of machinery and products. With change comes progress, and with progress comes obsolescence: and the alert concerns of industry must follow developments of any nature which may contribute to profit or loss, or to the changing industrial outlook.

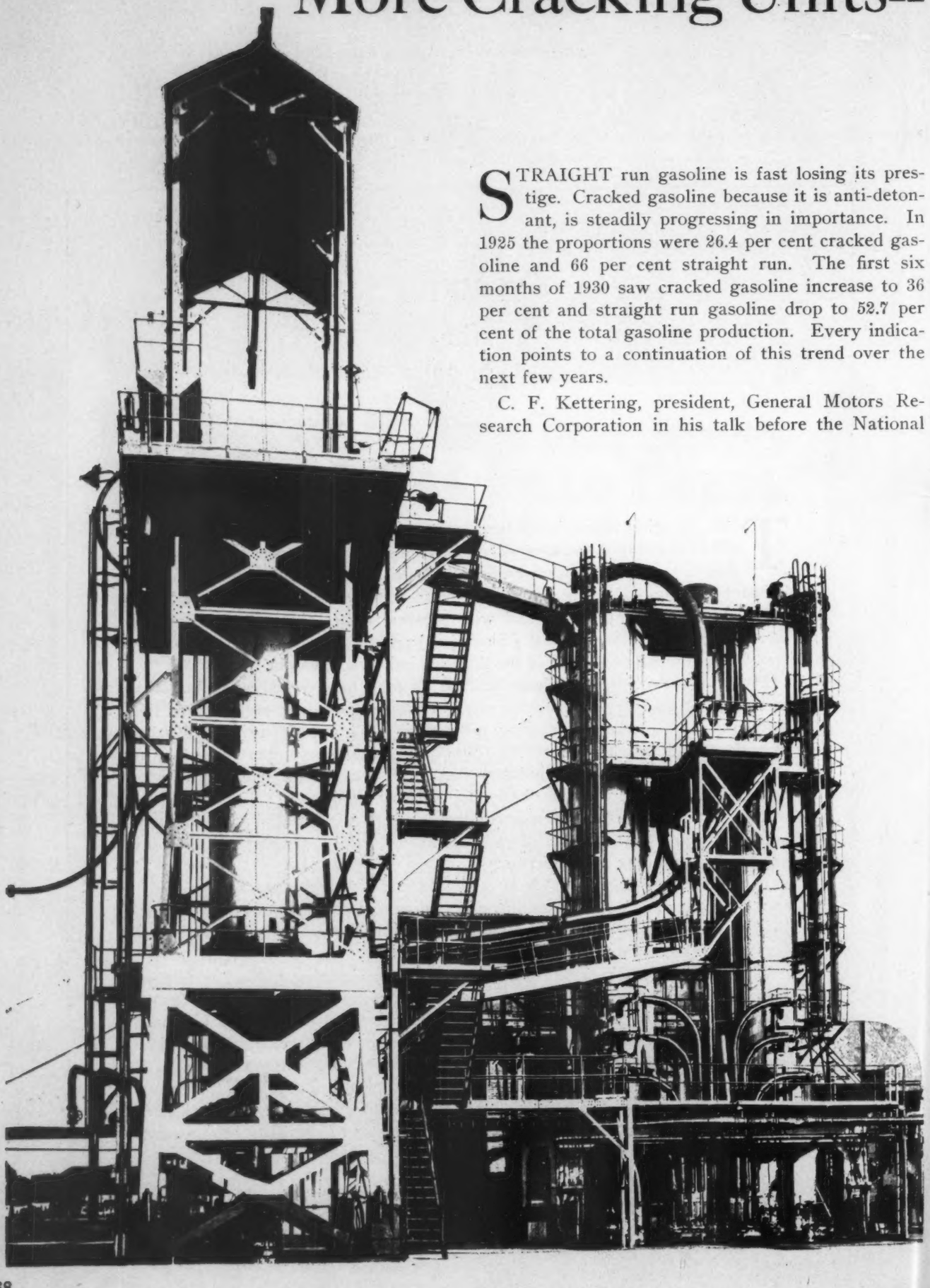
Progress in the refining industry is fast. It must be reviewed annually. The influences of such speedy progress must be anticipated where possible, and the influences of technical engineering progress in both manufacturing and sales extend into all departments of the refinery and natural gasoline plant; for in every processing step in this industry which produces a multitude of products, new and improved methods are here, and more are coming.

This sort of progress—and progress, that is, change, is essential or an industry becomes stagnant—calls for the best in the managerial, engineering and technical supervision, planning and designing.

In the following pages articles are presented having as their purpose the reviewing of progress and development in refinery departments, processes and products, indicating something of what the manufacturing branch of the petroleum industry must do in the coming year.

These discussions concern themselves with the changing market conditions insofar as they influence plant operation and the necessity of still greater expansion in the cracking of petroleum residues. The present trend in cracking unit installations is reviewed. Lubricant manufacturing methods are outlined with late developments in the three dominant methods of manufacture stressed. The possibilities of natural gas synthesis are presented and also the trend in natural gasoline manufacture. A review and forecast of the economics of the refining branch of the petroleum industry with preliminary estimates of operation requirements indicates something of plant operating conditions for the coming year.

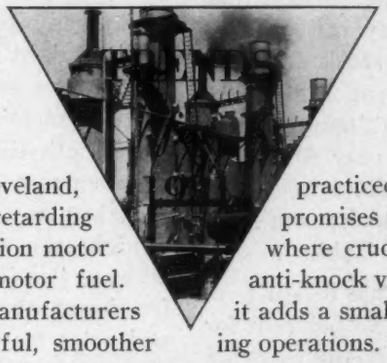
More Cracking Units--



STRAIGHT run gasoline is fast losing its prestige. Cracked gasoline because it is anti-detonant, is steadily progressing in importance. In 1925 the proportions were 26.4 per cent cracked gasoline and 66 per cent straight run. The first six months of 1930 saw cracked gasoline increase to 36 per cent and straight run gasoline drop to 52.7 per cent of the total gasoline production. Every indication points to a continuation of this trend over the next few years.

C. F. Kettering, president, General Motors Research Corporation in his talk before the National

Less Straight-Run Gasoline Production



Petroleum Association last April in Cleveland, stated that the only factor limiting or retarding the development of the internal combustion motor was the anti-knock qualities of the motor fuel. (REFINER, *May, 1930, p. 122*). Motor manufacturers are giving their customers more powerful, smoother operating, higher compression motors with improvements in such machinery handicapped, or at least progressing at lowered pace, because of available motor fuels limiting compression ratios and being otherwise not adaptable to needs of better motors. Such a condition virtually forces the refining industry to apply ways and means of preparing fuels meeting the demands of the motor users. This has brought about more cracking, and the same conditions prevalent over the next few years will necessitate still further cracking in both liquid and vapor phase cracking processes.

As those motors capable of operating on average straight run gasolines now operating and wearing out are gradually (and perhaps not so gradually after all) discarded and the users of new motors gradually, or perhaps speedily, increase, the demand picture is steadily changing. And this period of transition from a mixture of old type motors to a condition of all new and newer type motors which has prevailed for the last few years is nearing the end and refiners are considering means of providing proper motor fuels for motors operating during a new transition period wherein the present new motors are to be replaced with improved internal combustion engines demanding a different type of motor fuel. The present more or less generally accepted standard of say, 45 per cent benzol equivalent may easily increase to a standard of 65, 75 or 85 per cent benzol equivalent within the next few years.

Straight run gasolines for the most part and from most crude oils will of necessity have to be ethylized or some like and similarly efficient anti-detonant substance added to this product. To a large measure this condition prevails now.

An alternative lies in refractionation of straight run distillates in the motor fuel range, which is being practiced now to a small extent but which promises to become very general in refining areas where crude is processed yielding gasoline low in anti-knock value. Refractionation is simple, although it adds a small, additional cost to the present processing operations. The fractionating columns introduced in the natural gasoline industry with slight modification to allow for higher temperatures operation may well be utilized. The problem becomes one for solution by the individual refinery where operators are familiar with the crude at hand.

By careful analysis of the motor fuel distillate yield from the crude the operators determine that portion of their gasoline production best suited for present day (and future) motor fuel from the anti-knock standpoint. Then in their refractionating systems (often utilizing heat exchange, deriving heat from waste points on the high temperature cracking or skimming units), they virtually lift out of the solution this portion which is best suited for gasoline. This fraction may be large or small. The remainder is selected for such products as cleaning fluids, painters and varnish makers naphthas, rubber solvents, heating and lighting fluids, soaps, and other products. A recently perfected system calls for the extraction of virtually all of the "anti-knock hydrocarbons" from a given distillate by means of liquid sulphur dioxide.

This matter of separating the more valuable portions of straight run gasoline from the less valuable portions, involving as it does a separate fractionation, might appear far fetched and unsound, were it not for the fact that it is at present a practice that has proven profitable. Profitable practices have a way of proving popular. Premium motor fuels will only absorb a very definite percentage of the average straight run motor fuel. Beyond a given point little is to be gained by blending because of the lowered anti-knock value of the blend and the resultant increased requirements of the popular tetra ethyl lead. The tendency among refiners who ethylize, as the majority of them do, is to prepare a finished gasoline

of sufficiently high anti-detonating quality to reduce the per gallon requirements of "ethyl".

CRACKING EXPANSION

The total capacity of cracking units in this country is now virtually half that of the total refining capacity. (REFINER, *September, 1930, page 100*). This condition is not stationary, for additional cracking units are being installed at a rate of 75 to 100 units annually. Their requirements are fuel oil and gas oil for charging stock, with indications on the horizon that kerosene may well be cracked at comparatively low pressures. There is ample charging stock available for a great many more than the present 2000 cracking units. And they produced from skimming plant residues during the first half of this year 80,111,000 barrels of synthetic gasoline against 117,802,000 barrels of straight run gasoline all of which came from 477,657,000 barrels of crude run. See Table 1.

Straight run recovery has from crude to stills remained fairly stationary around 24 to 26 per cent for the past six years. The adaptability of the cracking unit to refinery residues has tended to lower the former high values of light crudes — unless those light crudes bore gasoline fractions of reasonably high anti-knock value. The continued increasing demand for powerful fuels of high anti-knock value may eventually take away from light crudes of high straight run gasoline content that enviable prestige they have so long enjoyed—for the cracking process, in order to provide motor fuel for the increasing number of modern motors must have increasing quantities of gas oil and fuel oil.

During this year the refining industry has added about 130 cracking units, increasing its cracking capacity by some 150,000 barrels. There are at this writing 48 units under construction with a total capacity of 88,650 barrels. New expansion programs recently announced and those contemplated, as well as a preliminary study of motor fuel requirements for 1931 are indicative of the continued construction of cracking process units throughout practically every refining district in this country, especially in the East Coast, Appalachian, and Illinois, Indiana, Ohio, refining districts, and this construction of new units next year should total about 100 new installations adding perhaps another 150,000 barrels cracking capacity to the present total of approximately 1,800,000 barrels.

Offsetting these increases will be the discontinuation of additional old Burton stills of which some 895 are now reported. In regard to this process there have been 324 Burton stills discontinued since the 1928 report when 1219 were reported. Other systems affected by dismantling, damage, and the like are the Lewis and Flemming units. None of the former remains, according to reports, and but four Flemming units are listed. During the past three years over 400 cracking units of obsolete type have been abandoned. At the same time new units have been going into service in sufficient numbers to offset this decline in number of units, and at the same time showing marked increases in total cracking capacity.

Company policies differ. Some refiners ethylize their straight run and market their cracked product to meet or create a demand for a non-premium priced gasoline meeting the demands of the modern engine. Others ethylize their cracked gasoline reducing the requirements of ethyl, provide an excellent motor fuel, but are handicapped with large quantities of straight run which moves slowly at regular prices because it will knock in some motors. Still others fractionate their straight run into a light gravity low end point motor fuel, thus improving it to some extent. Other refiners blend their straight run into the cracked product and ethylize to meet prevailing standards, sacrificing a few cents per barrel in order to move the straight run from storage tanks.

Where but a few years ago cracked gasoline in storage was the worry of the plant operator and the bane of the salesmanager's existance, the picture is slowly changing, as the accompanying Table 1 rather forcibly indicates, and perhaps the time is not far distant when straight run stocks will occupy that odious position formerly held by the cracked product.

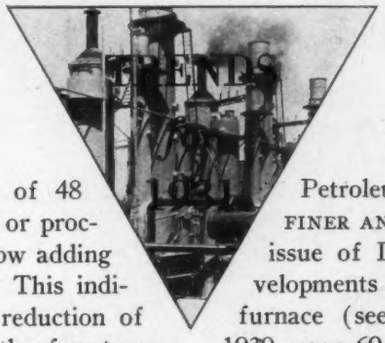
TABLE 1

Five years of Motor Fuel History showing the relation of Straight-run, Cracked, and Natural Gasoline*

Year	Total gasoline barrels	Total cracked-gasoline bbls. and pctge.	Total natural gasoline bbls. and pctge.	Total straight run gasoline bbls. and pctge.
1925	259,601,000	68,583,000	19,636,000	171,382,000
		26.4	7.6	66
1926	299,734,000	93,736,000	27,696,000	178,302,000
		31.3	9.24	59.5
1927	330,435,000	101,226,000	32,162,000	197,047,000
		30.7	9.7	59.6
1928	376,945,000	122,554,000	35,223,000	219,168,000
		32.6	9.4	58.0
1929	434,241,000	143,759,000	45,463,000	245,019,000
		33.2	10.4	56.5
First six mos. 1930	223,317,000	80,111,000	25,394,000	117,802,000
		35.9	11.36	52.74
Month of June, 1930	37,079,000	13,675,000	3,879,000	19,525,000
		37	10	53

*Source—Bureau of Mines annual and monthly reports.

Cracking Capacity Continues To Increase



WITH the present construction of 48 cracking units of various types or processes the refinery industry is now adding 88,650 barrels daily cracking capacity. This indicates that there has been no material reduction of expansion in this phase of refining recently; for at any time during the past few years it has been possible to list from 30 to 50 cracking installations under construction.

The present work reported, which is admittedly incomplete due to lack of full co-operation in surveying conditions, shows a decrease as compared to similar work done in July, 1929, when 99 units with a combined capacity of 168,800 barrels was reported in a survey published in THE REFINER AND NATURAL GASOLINE MANUFACTURER, issue of July, 1929, page 64 and 96. It is possible that the unavailable complete reports would indicate a building program more nearly equal that of a year ago.

At the time of publication of the previous survey, and according to Table 2, page 96, of the July, 1929, issue of this magazine, there had been 59 units erected and placed in operation with a total capacity of 135,500 barrels per day. Since that time the industry has completed construction work on its 99 units, (168,800 barrels capacity) and in addition has completed construction of 54 additional units with capacity of 112,200 barrels. Thus, within the past year the refining industry has increased its modern cracking capacity a total of 281,000 barrels through the addition of 153 cracking units. The details of this construction, showing name of company, type, number and capacity of units, are given in Table 2 accompanying this wrting.

Included in the 48 units now being erected are 10 units of De Florez process going in at various refineries of The Texas Company, at the Atlantic Refining Company's Philadelphia plant, and at two refineries of the Standard Oil Company of New York. The original unit of this type was installed at the Bayonne, New Jersey plant of Gulf Refining Company, and its operation was discussed by Mr. DeFlorez at the annual convention of the American Petroleum Institute, December, 1929. (See REFINER AND NATURAL GASOLINE MANUFACTURER, issue of December, 1929, page 67—and for developments during the past year in the De Florez furnace (see this publication, issue of November, 1930, page 69.)

Of the seven Cross units reported in Table 1, six are being erected in various foreign refineries, and one in this country for Continental Oil Company at its new Denver, Colorado, plant, which is now rapidly nearing completion. Included in the 19 Dubbs units being erected are two installations which have been placed in operation since the compilation of the two tables published at this time, but which were reported building in the annual survey of the Bureau of Mines, information circulation 6305. Ten of the 19 Dubbs units are being erected in various foreign countries, with nine going into service in this country.

Gyro Vapor Phase units (Pure Oil Company, developers) are being installed at Heath, Ohio, and Muskogee, Oklahoma, by Pure Oil Company, with three new units of 1,000-barrel capacity in course of erection at the company's new Toledo, Ohio, refinery. The Shell-Union group has become interested in vapor phase work and is erecting two of the larger 1,000-barrel Gyro units at the refinery of its subsidiary, Mexican Eagle Oil Company, at Tampico, Mexico.

Additional interest in vapor phase work is evidensed by the activities of Vacuum Oil Company which, through its subsidiary, Lubrite Refining Corporation, is adding two additional units of Pratt Vapor Phase type at its East St. Louis, Illinois, plant. The original development work on this process was done at the refinery mentioned. Complete details of the process, including flow charts and operation data were published in The Refiner and Natural Gasoline Manufacturer, issue of November, page 81. The process is being licensed by Automotive Distillate Corporation. Construction is now about complete on Shell Petroleum Corporation's True Vapor Phase cracking unit at Wood River, Illinois. Shell-

Union group through a subsidiary, Bataafsche Petroleum Company, and Petroleum Conversion Corporation, have formed a new company known as the Nieuwe Octrooi Maatschappij, which was formed to acquire and exploit patents, and the Shell group has secured contract for use of this vapor phase process in foreign countries. (See REFINER AND NATURAL GASOLINE MANUFACTURER, issue of November, 1930, page 162, and July, 1930, page 166.

Associated Oil Company at its Avon, California, refinery (rated capacity, 60,000 barrels per day), is erecting possibly the largest cracking unit in the industry, of Tube and Tank type, with capacity of 10,000 barrels per day.

Of the total units building as reported in Table 1—there are 11 vapor phase units with capacity of 12,500 barrels, 10 de Florez units with total capacity of 10,000 barrels and 27 liquid phase units with capacity totalling 66,150 barrels.

TABLE 1
Cracking Units Now Under Construction

Company and Type of Process—Location	Units	Unit Size Barrels	Total Capacity Barrels
CROSS UNITS—			
Continental Oil Company, Denver, Colorado	1	1,000	1,000
Mitsubishi Oil Company, Yokohama, Japan	1	2,000	2,000
Raffinerie de la Kironde, Bordeaux, France	1	2,500	2,500
Anglo Persian Oil Company, Abadan, Persia	4	4,400	17,600
Total Cross Units	7		23,100
De FLOREZ UNITS— (Distillate capacity reported)			
Atlantic Refining Company, Philadelphia	4	1,000	4,000
Standard Oil Co. of New York, Greenport, N. Y.	1	1,000	1,000
Standard Oil Co. of New York, Buffalo, N. Y.	1	1,000	1,000
The Texas Company, Lockport, Illinois	1	1,000	1,000
The Texas Company, Amarillo, Texas	1	1,000	1,000
The Texas Company, Port Arthur, Texas	1	1,000	1,000
The Texas Company, Dallas, Texas	1	1,000	1,000
Total De Florez Units	10		10,000
DUBBS UNITS—			
Emlenton Refining Company, Emlenton, Pa.	1	750	750
Independent Producers Refining Co., Logan, O.	1	1,000	1,000
Ohio Valley Refining Co., St. Marys, W. Va.	1	750	750
The Pennzoil Company, Oil City, Pennsylvania	1	2,500	2,500
Standard Oil Co., California, El Segundo**	4	3,000	12,000
White Star Refining Co.,* Trenton, Michigan**	1	1,800	1,800
Distillazione Italiana Combustibili, S. A. (Disca) Venice, Italy	1	750	750
Societe des Raffineries de Petroles de la Gironde, Bordeaux, France	1	2,500	2,500
A. Johnson & Co., Nynashamn, Sweeden	1	750	750
Raffineria de Petroleo, "La Isaura" Sociedad Anonima, Bahia Blance, Argentina, S. A.	1	750	750
Diadema Argentina Sociedad Anonima de Petroleo, Buenos Aires, Argentina, S. A.	4	2,000	8,000
Assam Oil Company, Ltd., Digboi, Assam, India	2	750	1,500
Total Dubbs Units	19		33,050
GYRO VAPOR PHASE—			
Pure Oil Company, Heath, Ohio	2	1,000	2,000
Pure Oil Company, Muskogee, Oklahoma	1	500	500
Mexican Eagle Oil Company (Shell Group), Tampico, Mexico	2	1,000	2,000
Pure Oil Company, Toledo, Ohio	3	1,000	3,000
Total Gyro Units	8		7,500
PRATT VAPOR PHASE UNITS—			
Lubrite Refining Corp. (Vacuum*), East St. Louis, Illinois	2	1,250	2,500
TRUE VAPOR PHASE UNITS—			
Shell Petroleum Corp., Wood River, Illinois	1	2,500	2,500
TUBE & TANK UNITS—			
Associated Oil Company, Avon, California	1	10,000	10,000
Total Pratt, T.V.P. and T. & T.	4		15,000
Grand total all Units	48		88,650

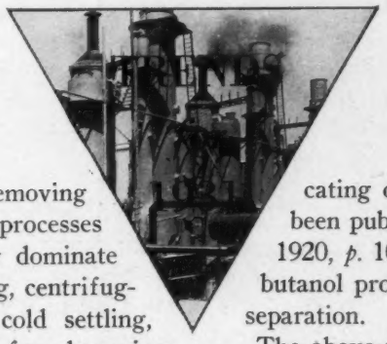
*Owned by Vacuum Oil Company.
**Bureau of Mines Information Circular 6305, Jan., 1930.

TABLE 2
Cracking Units Erected and Placed in Operation Since July, 1929, to July, 1930

Company and Type of Process—Location	Units	Unit Size Barrels	Capacity Total Barrels
CROSS PROCESS—			
Magnolia Petroleum Company, Beaumont, Texas	4	3,000	12,000
Nippon Oil Company, Japan	1	1,000	1,000
Standard Oil Company (Ind.) Whiting, Indiana	2	3,000	6,000
Pan-American Petroleum & Transport Company, Aruba, D. W. I.	8	3,000	24,000
The Texas Co. of California, Fillmore, Calif.	1	1,500	1,500
The Texas Company, Amarillo, Texas	1	1,800 [1]	1,800
The Texas Company, Lockport, Illinois	2	2,000 [1]	4,000
The Texas Company, Dallas, Texas	3	2,000 [1]	6,000
Barnsdall Refineries, Inc., Okmulgee, Oklahoma	1	1,500	1,500
Total, Cross [1](non-resid.)	23		57,800
DUBBS PROCESS—			
Independent Oil and Gas Co., Kansas City, Mo.	1	2,000	2,000
Independent Oil and Gas Co., Okmulgee, Okla.	1	2,500	2,500
New Orleans Refining Company—(now Shell Petroleum Corporation) Sellers, Louisiana	4	1,000	4,000
Shell Petroleum Corporation, East Chicago, Ind.	2	1,000	est. 2,000
Shell Petroleum Corporation, Houston, Texas	6	2,000	12,000
White Star Refining Company, Trenton, Mich.	2	1,500	3,000
Allegheny Arrow Oil Company, Canton, Ohio	1	700	700
Total	17		26,200
Dubbs-Foreign—No Capacity Report—No Company Report:			
Argentina, South America	4		
Continental Europe	10		
East Indies	7		
Egypt	1		
Japan	2		
Mexico	1		
West Indies	10	(35 frgn.)	est. 25,500
Total Dubbs	52		51,700
HOLMES-MANLEY—			
Gulf Refining Company, Port Arthur, Texas	6	3,000	18,000
Raffineria de Olii, Minerali S. A., Fiume, Italy	1	1,000	1,000
The Texas Company, San Antonio, Texas	2	2,000	4,000
The Texas Company, El Paso, Texas	1	2,000	2,000
The Texas Company, Watson, California	1	3,000	3,000
Total Holmes-Manley	11		28,000
JENKINS—			
Globe Oil & Refining Company, Cushing, Okla.	2	2,500	5,000
Iowa Park Producing & Refining Company, Iowa Park, Texas	1	2,500	2,500
LaSalle Petroleum Company, (Formerly Noble O. & G. Co.), Burkburnett, Texas.	1	2,500	2,500
Orient Refining Company, Wichita Falls, Texas.	1	2,500	2,500
Richardson Refining Co., Big Springs, Texas.	2	2,500	5,000
White Oak Gaso. Company, Allen, Oklahoma.	1	2,500	2,500
Raffinerie Nationales de Petroles, Bruxelles, Belgium	1	2,000	2,000
Russian Oil Commission, Russia	6	2,000	12,000
McColl Frontenac Oil Co., Ltd., Montreal, Can.	1	2,500	2,500
	16		36,500
GYRO VAPOR PHASE—			
Pure Oil Company, Smiths Bluff, Texas	1	—1,000	1,000
McColl Frontenac Oil Co., Montreal, P. Q.	2	— 750	1,500
Petroleum Refineries, Ltd., Killingholme, Eng.	4	500	2,000
	7		4,500
PRESSURE COKE—			
The Texas Company, Lockport, Illinois	2	1,500	3,000
The Texas Company, West Tulsa, Oklahoma.	4	1,500	6,000
The Texas Company, West Dallas, Texas	3	1,500	4,500
The Texas Company, Casper, Wyoming	1	1,500	1,500
The Texas Company, Port Arthur, Texas	2	1,500	3,000
	12		18,000
WINKLER-KOCH—			
Globe Oil & Refining Company, Lemont, Ill.	1	6,000(S&C)	6,000
RICHMOND—			
Pasotex Petroleum Company, El Paso, Texas.	1	4,000	4,000
BURGER—			
Gulf Refining Company, Port Arthur, Texas.	14	2,820	39,500
PIPE STILL—			
Root Refining Company, El Dorado, Arkansas.	1	2,500	2,500
DOHERTY—			
Empire Oil & Refining Co., East Chicago, Ill.	6	1,500	9,000
TUBE AND TANK—			
Standard Oil Company of New Jersey, Baltimore	2	3,000	6,000
Standard Oil Company, New Jersey, Bayonne.	4	3,000	12,000
Latonia Refining Company, (S. O., Ohio), Latonia, Kentucky	1	2,500	2,500
Total T. & T.	7		20,500
DONNELLY—			
Illinois Oil Company, Cushing, Oklahoma	1	1,500	1,500
Laurel Oil & Refining Company, Laurel, Mont.	1	1,500	1,500
Grand total all units	153		281,000

Manufacture Of Low Pourpoint Oils

By E. R. LEDERER and E. W. ZUBLIN
Texas Pacific Coal & Oil Company



OF the various possibilities for removing wax from oil, three outstanding processes have developed, that practically dominate the field today. They are: Cold pressing, centrifuging and filtering with a filter aid; cold settling, once the universally applied method for dewaxing bright stocks, is vanishing rapidly, being displaced by the more efficient centrifuging and filter aid methods. The application of selective solvents constitutes a further possibility.

Solvent processes have attained little general importance to date, one commercial plant employing solvent extraction being in operation in Illinois. With the present market situation, however, the application of solvents seems to be prohibitive on account of the inevitable loss of some of the costly solvent. On the other hand, by solvent extraction methods it is possible to manufacture oils of low temperature properties not even approached by the best of present-day commercial products. Paraffin oils having a Saybolt viscosity of 80 @ 210°F. and an A.S.T.M. pourpoint of —40°F. have been prepared on a small scale. Their fluid properties at zero and below vastly exceed those of any product now sold on the market.

Solvents, such as acetone, isopropyl alcohol, butanol, etc., employed in such processes, have a preferential solubility for aromatic and naphthenic compounds as against aliphatic hydrocarbons. The relative solubility, in butanol for instance, of the various groups of compounds is illustrated by the following table:

TABLE 1

Resinoids	Very soluble to slightly soluble
Aromatics	
Poly-Naphthenes	
Naphthenes with aliphatic chains	
Iso-aliphatic	
Normal aliphatics	

Figures of solubilities of paraffin wax and two lubricating oils in a large number of solvents have been published by J. W. Poole (*Ind. Eng. Chem.* 1920, *p.* 1098). Poole comes to the conclusion that butanol produces the best results in regard to wax separation.

The above table is substantiated by Poole's and the following figures obtained in our laboratory:

TABLE 2
Solubilities in Butanol
(Ratio of solvent to oil—5:1)

Oils—	Vis. @ 210	V.I.[1]	0°F.	% Soluble @ °F. 32	50	80	100	120
Gulf Coast	118	—10	95	95	95	99	100	100
Blend[2]	117	75	50	60	60	65	85	99
Mid-Continent	120	76	30	30	40	48	60	75
Pennsylvania No. 1	115	99	30	30	45	50	60	75
Pennsylvania No. 2	120	100	20	25	35	35	50	60

[1]Viscosity index, Dean and Davis, Chem. & Met., November, 1929.
[2]Blend of 1/3 Gulf Coast and 2/3 Penna. No. 1 oils.

Paraffin waxes are aliphatic compounds (*Ferris, Cowles & Henderson, Ind. Eng. Chem., 1919, p. 1090*). The most desirable lubricants are found among naphthenes and poly-naphthenes. Thus by properly regulating temperatures and solvent circulation, it is possible to isolate the "center groups" of Table 1 to get rid of the aliphatic and aromatic compounds.

Several patents have been issued covering the use of solvents for dewaxing, E. R. Wiles, United States Patent No. 1,684,426 (1928), and R. S. Lane, United States Patent No. 1,706,120 (1929), describe the use of mixtures of butanol and acetone for the extraction of wax. R. E. Wilson, United States Patent No. 1,719,350 (1929), precipitates the bulk of wax with iso-propyl alcohol at low temperatures.

COLD PRESSING

Cold pressing is applicable to overhead oils only. The success of cold pressing depends entirely upon good crystallization of the wax, preferably in the form of needles rather than plates. "Needles" are better than "plates" because they form a more porous cake, through which the oil filters more readily.

Several investigators have studied the factors causing the wax to crystallize in the one or the other form.

THE three important and widely used methods of removing wax from oil and the three processes which dominate the field are discussed in this article concerned with the manufacture of low pourpoint lubricants. This work by Dr. E. R. Lederer, vice-president, and E. W. Zublin, chief chemist, Texas Pacific Coal & Oil Company, was presented by the authors at a recent chapter meeting of the American Chemical Society at Tulsa, Oklahoma.

Dealing with such methods as the Solvent processes, the Cold Pressing, Cold Settling, Centrifuging, and Filter aid processes, the article directs attention to the advantages, disadvantages, results secured and peculiarities of stocks treated traceable to pre-processing in distillation and chemical treatment. The work is an interesting and valuable resume of the progress in dewaxing processes.

Padgett, Hefly and Hendrickson (*Ind. Eng. Chem, 1926, p. 832*) and Buchler and Graves (*Ind. Eng. Chem. 1927, p. 718*) showed that certain impurities or inhibitors in the oil are responsible for the formation of "needles," which in fact are nothing but curled up "plates." Tamaka, Kobayashi and Sadayuki (*J. Faculty Eng. Tokyo Imp. Univ. 17, 1928, p. 289*) believe the viscosity of the oil to be the cause, the higher viscosity causing the plates to curl. Evidence throughout the literature indicates that the conclusion of the Japanese investigators is erroneous. It so happens that heavier oils from the same crude contain the larger amount of inhibitors, because the inhibitors are known to be substances of high boiling points; and what seems to be caused by an increase in the viscosity is actually due to the higher percentage of inhibitor which accompanies any viscosity increment.

Excessive amounts of inhibitor will prevent crystallization entirely. It has taken the industry a long time to recognize the cause of poor crystallization, that may render wax distillate nonpressable. Inhibitor carried over by entrainment or poor fractionation frequently played havoc with wax presses. Operators believed that cracking was essential to obtain crystalline pressable wax, and as late as this year, investigators found it necessary to preach to the industry that in the fractionating tower the decision is rendered whether or not the wax be pressable. (*H. J. Dunmire, "The Crystallization of Wax in Paraffin Distillate,"* REFINER AND N.G.M., *May, 1930, p. 136*). Cracking a poorly fractionated paraffin distillate to make it pressable is nothing but destroying the inhibitors of tar and resinlike nature. Adding a small percentage of a good solvent for the inhibitors such as acetone, chlorinated aliphatic compounds, etc., has a similar effect on crystallization as cracking has. Absence of moisture is desirable as it helps the case of filtration.

By carefully controlling the distillation and by pressing in two stages, it is possible to make zero pourpoint light neutrals. Pressing in two stages is necessary for this purpose because in most cases the wax content is so high, as to make the oil nonpressable at very low temperatures by reason of overaccumulation of crystals. It is understood that the rate of chilling must be kept as low as commercial operation will permit it. It is a law, known to every chemist, that the size of crystals increases as the time of crystallization is lengthened.

Some crudes yield heavier pressable wax distillates than others. This depends upon the nature, boiling range and concentration of inhibitors in the crude. It has been shown that in the case of certain crudes a very sharp break may occur; a variation in the yield of overhead by one or two per cent can change a wax distillate from completely nonpressable to pressable or vice versa. In this respect every crude presents an individual research problem.

COLD SETTLING

Cold settling, the once universal process for bright stock dewaxing consists essentially of diluting the stock with about 70 per cent of light naphtha, chilling and allowing to settle. While this procedure sounds simple enough considerable difficulties were experienced continuously. Frequently the wax would not precipitate and settle at all. Various reasons were attributed to such failures. C. L. Jamieson (*N. P. N., 1928, No. 39, p. 89*) claims that the humidity of the atmosphere in the cold settling tank influences the rate of settling greatly. While this may be true, it is rather doubtful, that this factor could also be responsible for the complete failure to precipitate. Moisture in the oil is more likely to cause serious trouble. Overheating during the distillation may give rise to the formation of gummy substances, which may act as inhibitors. In the case of Mid-Continent oils, incorrect acid treatment may be a source of trouble; and last but not least the rate of chilling is a factor to be watched.

For successful cold settling, three demands must be satisfied:

1. The wax must be of the proper formation, that is to say, must not be crystalline but amorphous. The amorphous particles must be larger than of colloidal size, as particles below a certain size will remain in suspension. This state or formation has been termed in the literature (and in the writers' opinion falsely) "intermediate," as being between crystalline and amorphous. There is serious doubt, whether a truly intermediate state can exist. It is even doubtful whether so-called amorphous wax is truly amorphous. Jones and Blackley (*Ind. Eng. Chem., 1929, No. 21, p. 318*) propose a very plausible theory based on surface tension and colloidal phenomena to explain the occurence of "amorphous" wax. They believe that some crystallization inhibitor is adsorbed on the surface of the minute wax particles, increasing their surface tension. This causes them to become surrounded by a protective film

of oil which prevents the ready growth of the crystals. Any condition favoring the adsorption of inhibitor should accentuate the formation of amorphous wax. For instance, lowering the temperature to a point where the inhibitor begins to change from true solution to colloidal state will result in smaller wax particle size, because the inhibitor is more readily adsorbed in its colloidal state. For this reason, wax formed at lower temperatures is likely to be of smaller size, than that precipitated at higher temperature from the same oil. In other words, dewaxing becomes more difficult and inefficient as the temperature is lowered beyond a certain point.

In as much as cold settling depends on the small gravity differential only between oil solution and wax for separation, the temperature limit for this method is quite high.

2. The second demand to be satisfied, is the viscosity of the solution, which must be sufficiently low to permit the wax particles to settle readily.

3. The oil solution must have a low specific gravity to cause the highest possible gravity differential between solution and wax.

CENTRIFUGING

Presently it was found desirable to have a greater force for separation than the natural gravity differential and in consequence the centrifuge was put into service. The difficulties encountered in the beginning are well known. The application of the liquid carrier on the rotor for continuous wax discharge was probably one of the greatest steps toward the manufacture of zero pour-test bright stocks.

The carefully topped, and in the case of Mid-Continent oil, acid treated stock is subjected to a clay treatment, and then is diluted with 70 per cent naphtha of low specific gravity and low vapor pressure—in other words, a close cut naphtha. Low specific gravity is necessary to produce the gravity differential between wax and oil solution just as in the case of cold settling. A low vapor pressure reduces evaporation loss. The blend is first slowly chilled in insulated tanks from 110°F. to 20°F. at the rate of 3° to 5°F. per hour. From there on to —60°F. the rate of chilling can be increased. Paddles in the chilling tank keep the solution in constant but slow motion to insure equal chilling and to prevent the wax from settling. After reaching the final chilling temperature the solution is pumped into a receiving tank from where it flows by gravity into the centrifuges. Hot water of about 150°F. is fed into the head of the machines. This provides the liquid carrier which carries the solid wax continuously through the discharge.

The machines that rotate at about 18,000 to 19,000 r.p.m. must be watched carefully. Impurities, heavier than water, such as clay from percolation or contacting must be removed, because they plug the wax outlet, making complete wax removal impossible.

The oils thus obtained have a pourtest of from 30° to 50°F. higher than the lowest chilling temperature.

El Segundo Refinery, Standard Oil Company of California

The efficiency of dewaxing depends upon many factors; such as treatment of the lube stock, gravity and percentage of naphtha, and a number of mechanical adjustments on the centrifuge proper.

The petrolatum obtained in this manner from Ranger crude, after complete removal of the naphtha, has a melting point of from 125° to 140°F. The more completely the oil is dewaxed the lower is the melting point of the resulting petroleum. Analyses made by butanol extraction show it to contain about 50 per cent wax of high melting point and 50 per cent of oil and some waxes of very low melting point.

SPECIAL MEANS REQUIRED

In order to dewax neutrals by the centrifuge method special means must be applied. Truly crystalline wax cannot be separated by centrifuging due to its frame-like structure and its low surface tension. If, however, an inhibitor is added that prevents crystallization, centrifuging of the neutral becomes possible. A patent has been granted to P. T. Sharples covering the addition of soft wax obtained from dewaxing bright stock to neutrals for the purpose of making them fit for dewaxing by centrifuging.

As has been pointed out, dewaxing based on gravity differential between oil solution and wax becomes less efficient as the temperature is lowered. The centrifugal force is limited by the properties of the centrifuge which cannot be built beyond a certain diameter and run be-

yond a certain speed for safe operation. The gravity differential is limited by the proportion and gravity of the naphtha used for diluting. The only other variable affecting separation is the particle size of the wax. The ease of separation is directly proportional to the mass of the particle. The factor governing the particle size, besides the rate of chilling, is evidently the quality and quantity of inhibitor present. Wax particle size therefore is controlled by the treating method employed previous to the chilling operation. It follows that, once the proper treating method has been established, accurate plant control is of vital importance for the successful production of zero pour test oils.

Some investigators have tried to increase the efficiency of low temperature dewaxing by such means as double centrifuging (*G. F. Olsen, U. S. 1,715,670*); addition of crystalline wax (*Suhr and Zehrung, U. S. 1,737,737*); removing inhibitor by centrifuging (*Nobel concerns, Swed. 64,383, January 4, 1928*); precipitation with the aid of litharge particles (*Naylor, U. S. 1,722,307*); etc. Of particular interest is the process employing double centrifuging. Though the equipment is rather expensive on account of the extra machinery required, the process is economical on account of its efficiency. Two centrifuges are connected in series: The first one is accurately adjusted to produce a petrolatum as free from oil as possible, the second one has a slack adjustment, removing the wax completely from the already partly dewaxed oil, but allowing oil to be carried over into the petrolatum. This oily wax stream is recirculated and mixed with fresh wax-bearing oil. It is claimed that the recycle wax aids materially the precipitation of wax in the fresh oil.

WEIR PROCESS

The last of the dewaxing processes in use today is the filter process employing a filter aid, known as the Weir process. Hyflo-Super cel is mixed with the diluted and chilled oil at the rate of about one pound per gallon of lube stock. The mass is kept in slow agitation to prevent settling of the solids and then is forced through a filter. Filter cel being extremely abrasive cannot very well be handled with pumps. Gravity flow has been employed and during experiments carried out at the laboratories of Texas Pacific Coal & Oil Company, gas pressure was used successfully. Gas has the advantage over air, that it contains less moiture and does not form explosive mixture in the pressure tanks.

The rate of dilution is about the same as employed in centrifuging. However, no particular grade of naphtha is required. The economy of this process depends, besides the degree of dilution, on the rate of flow per hour per square foot of filtering surface, differential between chilling and pourpoints, recovery of petrolatum and of the filter aid. In a paper by E. R. Lederer and R. Beatty presented before the American Petroleum Institute in December, 1929, a number of data were presented on the various factors influencing the rate of flow. One of the peculiarities found during the investigation carried out on treated long residuum from Ranger crude was that the rate of filtration dropped suddenly to a very small figure if the dilution was reduced to below a certain limit. The following table is taken from the above mentioned paper:

TABLE 3
Naphtha Content and Rate of Distillation

	— Run number —				
	32	30	31	40	34
Chilling temp.	—40	—40	—40	—40	—30
Pounds Hy-flo super cel	½	½	1	1	1
Per cent naphtha.	75	66	75	66	50
Grade of oil.....	*	*	†	†	†
Rate of filtration gal. per sq. ft. per hour	15	13	15	0.3	0

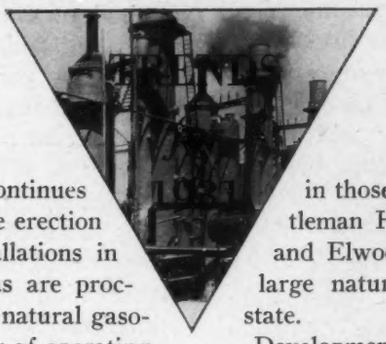
*From Sharples plant. †Treated long residuum.

During the discussion following the presentation of the paper, some doubt was expressed as to the conclusiveness of these results. It is the writer's opinion that they are conclusive at least for the particular oils investigated and it is believed that similar figures would be obtained with long residuum oils from other Mid-Continent paraffinic crudes. Vacuum distillation of the stock may change this peculiar break in the curve. As a possible explanation it is suggested that the concentration of both, inhibitor and wax, caused the formation of such extremely small wax particles that the filter was clogged in spite of the filter aid. It was not the stiffness of the suspension by any means that caused the difficulty. In fact, the suspension was quite mobile. The explanation becomes even more plausible if we compare the filter rates of centrifuged and uncentrifuged stocks in 66 per cent dilution. Centrifuging removes, together with wax, a large percentage of inhibitor. Thus upon further chilling the wax will precipitate in sufficiently large particles to be filterable with a filter aid. Another factor to be watched is the pressure upon the filter. The wax is of a soft semiplastic nature and if high pressures are applied from the beginning, the filter cake has a tendency to become clogged. The minimum pressure maintaining a good filter rate is the best. As the cake grows in thickness pressure must be increased gradually to a point where the safety limit has been reached. If conditions are favorable for filtration, the press may fill up with filter cake before the maximum permissible pressure has been attained.

On comparing lub stocks from various crudes, all obtained by exactly the same treating method, it was found that the ease of filtration varies a great deal. In our laboratory the Weir process is used in the regular procedure for analyzing crudes. The oil is filtered by vacuum. Oils derived from crudes from certain fields have yielded filter cakes up to three inches thick before scraping of the leaves became necessary, while cakes of some oils from other sources had to be discharged at thicknesses of one-half inch or even below.

Natural Gasoline Facts and Factors

By GEORGE REID
Associate Editor



THE Natural Gasoline Industry continues to expand its capacity through the erection of highly efficient modern installations in which greater quantities of natural gas are processed and greater volumes per plant of natural gasoline are manufactured, while the number of operating units in the industry continues the decrease begun in 1927 and 1928.

The decrease in number of units operating is attributed to dismantling caused by natural gas depletion in older producing areas and to the abandoning of obsolete and wornout plant equipment. Bureau of Mines surveys for 1928 and 1930 show that 86 compression plants were removed from the listings, and a decrease of 40 absorption plants and four charcoal type units. There have been further decreases during the past year but the details are not yet available.

It is possible to forcast with a fair degree of accuracy the number of gasoline plants which the petroleum industry will install during any given period just as past years records indicate the building of gasoline plants due to the necessity of processing natural gas production in newly developed oil and gas fields. The natural gasoline plant, to a large extent, must follow the drill, for with the production of oil and gas it becomes necessary in most areas to process the gas for gasoline extraction before such gas can be used for carbon production or fed into natural gas pipe lines.

During the past 12 months published record of new natural gasoline plants appearing in this magazine in the department of Refinery and Natural Gasoline Plant Activities indicate that a total of 45 new installations were erected. This does not include some 20 larger expansion programs involving in many instances a doubling of capacity at plants already of large capacity, nor does it include several smaller new plants concerning which no news items were published.

Since more rapid development of oil and gas producing area took place in Oklahoma, California, Texas and New Mexico, it follows naturally that gasoline plant erection last year was concentrated in those states. Due to the exploitation of Kettleman Hills, Playa del Rey, Protrero, Belridge, and Elwood, in California, there were eight new large natural gasoline plants constructed in that state.

Development of the Oklahoma City area and continued expansion of productive territory in and around the Greater Seminole area of Oklahoma 15 new plants were placed in operation there. In the Hobbs area of southeastern New Mexico five natural gasoline plants were finished during the past year. In the Louisiana gas fields two new plants were built and several enlargements finished, while the same number were erected in Kansas. In Central and West Texas, the Van area of East Texas, and the Panhandle region 13 new natural gasoline plants were constructed and placed in operation.

These new installations added rated capacity as follows, Oklahoma 397,000 gallons daily, California 355,000 gallons, Texas 286,000 gallons, New Mexico 83,000 gallons, Louisiana 45,000 gallons, Kansas 15,000 gallons—or a total of new rated capacity of 1,181,000 gallons gasoline per day. During this time there were a score or more plants dismantled or shut down, but not of sufficient total rated capacity to materially affect the increase brought about by new construction.

NEW PLANTS

At present there is much to indicate that the coming year will see an equal number of new natural gasoline plants erected since drilling activity continues in the newer territories. Northern and Southern California will without doubt require an additional dozen large natural gasoline plants to care for the natural gas production potentially available in the fields now being developed and exploited, and the discovery and exploitation of any new areas not now producing will influence this plant building program toward a high number of installations. Several plants in the Los Angeles Basin fields of Southern California will have to be enlarged this year.

Continued development in the Oklahoma City field

and perhaps other fields in that vicinty, and the widening of productive territory in the Central part of Oklahoma will necessitate the erection of several additional gasoline plants in that state. Kansas and Louisiana have not extended their plant construction beyond the need for additional gasoline extraction facilities sometime during the next year.

Activity in East Texas in such areas and Van and the Joiner district, continued repressuring projects in the Gulf Coast territory, and new gas production in West Texas and in the Panhandle territory will necessitate the erection of additional gasoline plants in these areas, with some possibility for further construction in North Central Texas. It is not expected that the eastern fields of Ohio, Michigan, Pennsylvania, West Virginia, and Kentucky will require additional gasoline plants excepting where new units may replace plants now obsolete.

GASOLINE PRODUCTION

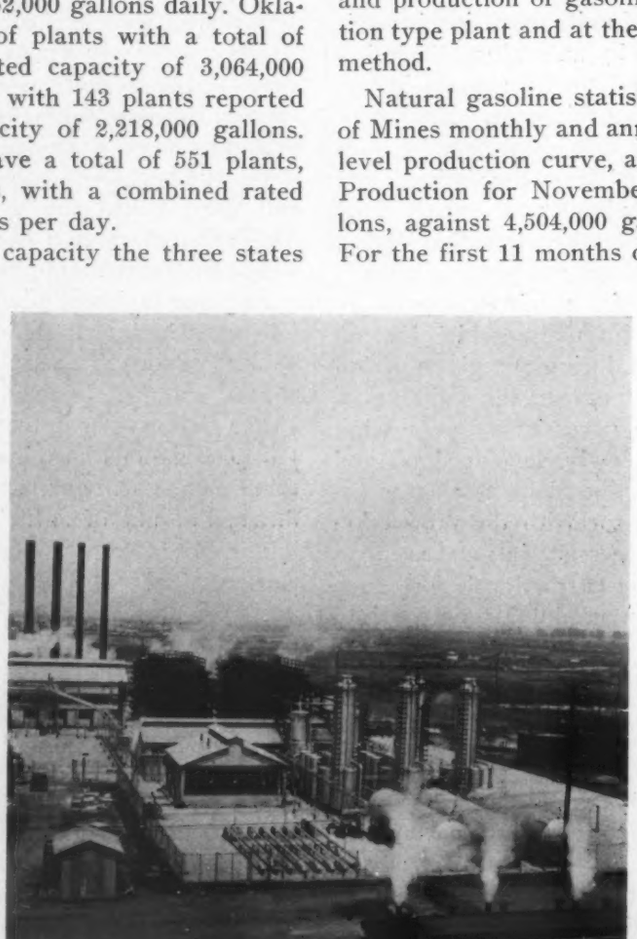
Natural gasoline capacity is mostly concentrated in three states with California leading, Oklahoma second and Texas third. In California, according to the latest report of the Bureau of Mines, 144 plants had a rated capacity of 3,452,000 gallons daily. Oklahoma leading in number of plants with a total of 246 installations had a rated capacity of 3,064,000 gallons per day and Texas with 143 plants reported also reported a daily capacity of 2,218,000 gallons. These three states then have a total of 551 plants, according to latest reports, with a combined rated capacity of 8,734,000 gallons per day.

With this total of rated capacity the three states mentioned have slightly over 84.5 per cent of the total rated operating capacity of the industry which is reported as 10,278,000 gallons per day with a total of 999 operating plants. Thus the 13 other gasoline producing states with 448 operating plants have a total rated operating capacity of but 1,544,000 gallons daily. Total plants in the last report were given as 1035 with aggregate rated capacity of 10,516,000 gallons, and with 36 plants of total capacity rating of 238,000 gallons shut down. Thus California, Oklahoma and Texas have a combined total rated capacity equivalent to 83 per cent of the total capacity of the natural gasoline industry. This gasoline was produced through 55 per cent of the operating plants.

Latest available estimates state that the natural gasoline industry consists of 486 absorption plants which have a total rated capacity of 7,956,000 gallons per day which is approximately 75 per cent of the reported capacity of the industry. The compression method of operation was still represented by 411 plants but their total rated capacity was only 1,063,000 gallons per day. Combination plants numbered 115 with a total rated capacity of 1,311,000 gallons, and charcoal plants were reported at 23, with rated capacity of 186,000 gallons per day.

Compression type natural gasoline plants are still being installed in certain areas where gas lift practices prevail, operating in conjunction with modern stabilization units. However, the trend in new installations is decidedly toward the absorption type plant and stabilization unit and future reports will continue to show increases in both number of plants and production of gasoline by means of the absorption type plant and at the expense of the compression method.

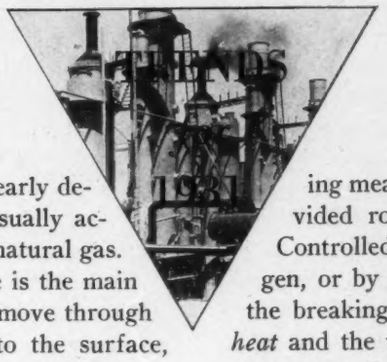
Natural gasoline statistics taken from the Bureau of Mines monthly and annual reports indicate a fairly level production curve, and small increase in stocks. Production for November, 1930, was 4,238,000 gallons, against 4,504,000 gallons for November, 1929. For the first 11 months of 1930 the natural gasoline industry produced 47,538,000 gallons of gasoline against 47,814,000 gallons during the first 11 months of 1929. Stocks of naturals at the end of the 11-month period, 1930, are reported as 25,032,000 gallons, as against 21,588,000 gallons at the end of November, 1929, which indicates an increase in stocks during the past year of 3,444,000 gallons, based on November reports.



The Texas Company's Natural Gasoline Plant No. 5, Signal Hill, California

Possible Use of Natural Gas For Chemicals*

By HAROLD M. SMITH[1]



THE production of oil during the early development of new oil fields is usually accompanied by large quantities of natural gas. Since in most fields gas under pressure is the main source of the energy causing the oil to move through the sands into the wells and thence to the surface, this coincident production of natural gas will continue as long as present day producing methods are used. Generally the use of this gas is restricted, and markets are not readily available. Consequently, a large portion of the gas produced at such times is often wasted by being blown into the air.

The magnitude of gas waste is well brought out in the following statement by Miller—:[2] "Only a few outstanding examples need be cited to show the enormous production of gas that accompanies the discovery of new sources. In April, 1927, the Ventura field produced approximately 210,000,000 cubic feet of gas a day; and during the summer of 1927, Alamitos Heights reached a peak gas production of 102,000,000 cubic feet a day; on December 1, 1928, as a result of the summer's deeper drilling in the Long Beach field, surplus gas production amounted to 125,000,000 cubic feet a day. It is estimated that in January, 1929, the Santa Fe Springs field will have a daily gas production of 387,000,000 cubic feet from the recently discovered Buckbee oil zone. Of this amount 274,000,000 cubic feet a day will be the surplus above the amount required for field and plant fuel, taken out by utility corporations, and that used in repressuring the Meyer sand which lies above the Buckbone zone."

This illustration is typical of the gas loss in oil fields all over the world, and within the last few years a large amount of thought and engineering effort has been directed toward finding means of utilizing this gas profitably.

One possible method of utilization is in the manufacture of chemical products, and much work has been done on the various types of reactions that might be of commercial value. The reactions offering means of approach to the problem may be divided roughly into three general classes: (1) Controlled oxidation, either with steam, or by oxygen, or by gases containing oxygen; (2) pyrolysis, the breaking up of the hydrocarbon molecules with *heat* and the uniting of these parts to form new substances, or, in the extreme, the decomposition to carbon and hydrogen; (3) chlorination, the replacement by chlorine of more or less hydrogen in the hydrocarbon molecules.

The Bureau of Mines has been actively studying certain of these reactions for some time, the purpose being to develop simple and economical means for utilizing gas which otherwise would be wasted. The Pittsburgh station has been studying the oxidation processes particularly, and the Bartlesville station has been investigating the possibilities of pyrolysis, exclusive of cracking direct to the elements carbon and hydrogen.

Some of the products which are obtainable by the various reactions are indicated in the accompanying chart, the data for which have been in a large part obtained from the literature. At present very few of these products can be obtained on a commercial basis by synthesis from natural gas, and in fact some of the products have been found only in relatively small amounts in laboratory experiments. In the present-day development of chemistry, however, that which is curious today becomes commonplace tomorrow, so that in studying the possibilities of these various reactions the chemist makes no apology for considering the apparently insignificant products that are of minor commercial importance at present.

A brief description of the principle reactions by which natural gas may be transformed into other chemical products follows. The more important application of these products is also indicated at the same time.

OXIDATION

"Recently there has been much interest in the hydrogenation of oils. An important method of obtaining the necessary hydrogen is by the interaction

*Reprinted from U. S. Bureau of Mines Information Circular 6388.
[1]Associate petroleum chemist, U. S. Bureau of Mines.
[2]Miller, H. C., Function of Natural Gas in the Production of Oil: A report of the Bureau of Mines in cooperation with the American Petroleum Institute, 1929, 321 pp.

of natural gas and steam at temperatures of about 500 C. or lower in the presence of catalysts such as iron oxide. The products are chiefly hydrogen and carbon dioxide. The latter is removed by suitable scrubbing, and fairly pure hydrogen is thus obtained. Its major uses are as a reducing agent in the process industries; the hydrogenation of mineral and vegetable oils and coal; and the synthetic production of ammonia, which is widely used as a refrigerant, and in the manufacture of fertilizer."

Methane also reacts with steam at 900°C. (1652°F.) in the presence of suitable catalysts to give a mixture containing one volume of carbon monoxide and three volumes of hydrogen: $CH_4 + H_2O = CO + 3H_2$. This mixture of carbon monoxide and hydrogen (water-gas) is the basis for several catalytic syntheses. (1) At high pressures (50-200 atmospheres) and at temperatures of 200 to 400°C. (392-752°F.) in the presence of suitable catalysts water gas yields methanol (methyl or wood alcohol). Methanol is used widely as a solvent, a denaturant, and an organic intermediate in the formation of other compounds. (2) At atmospheric pressure in the presence of iron or cobalt catalysts many compounds may be formed, among them liquid hydrocarbons and oxygenated compounds which could be blended with gasoline. Acetone, a valuable solvent and intermediate for nitrocellulose lacquers and explosives may be obtained by a similar process.

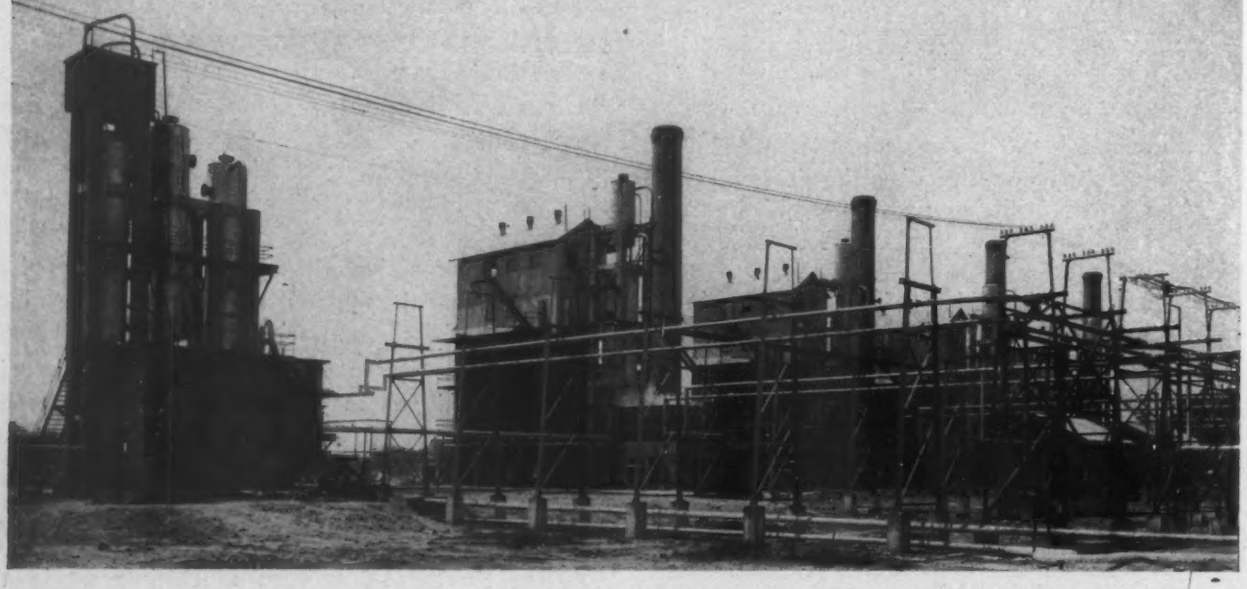
Methane, with the proper catalysts and under suitable conditions of temperature and pressure may be oxidized directly by oxygen, or oxygen-containing gases such as air or NO_2 to formaldehyde: $CH_4 + O_2 = CH_2O + H_2O$. Formaldehyde has in recent years become of much importance in the synthesis of resins such as bakelite. Formaldehyde is also a valuable antiseptic.

PYROLYSIS

When methane is subjected to temperatures of 1,800 to 2,200°F. it breaks up or "cracks." At slightly lower temperatures the parts reunite, but form new products as they combine. This higher hydrocarbon gases also break up and reunite to give various products different from the parent substances. At sufficiently high temperatures the gas will decompose to carbon and hydrogen.

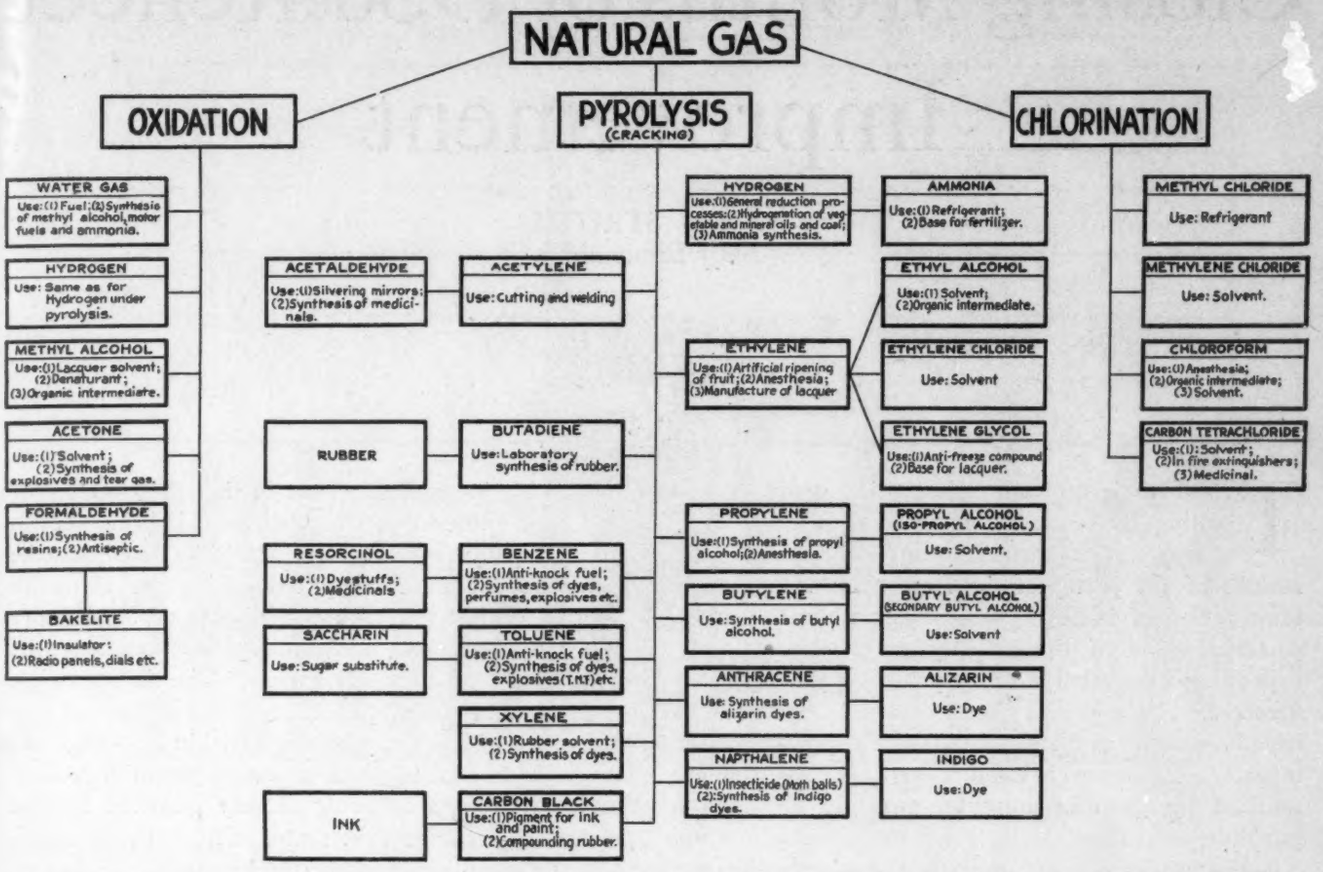
In either type of cracking, hydrogen is always set free and by suitable means can be isolated and used commercially, as previously mentioned under the discussion of production of hydrogen by oxidation. Its major uses are as a reducing agent in the process industries; the hydrogenation of mineral and vegetable oils and coal; and the synthetic production of ammonia, which is widely used as a refrigerant and in the manufacture of fertilizer.

Other gases formed in the pyrolysis of natural gas are acetylene, butadiene, ethylene, propylene and butylene. Acetylene is used in welding and cutting metal; and may be used to prepare acetaldehyde, which is further used in silvering mirrors or in the preparation of medicinals such as chloral, a soporific. Butadiene under proper treatment condenses to form an artificial rubber having the same general composition as natural rubber. Ethylene has recently come into use in ripening fruits. It is also finding use as an anesthetic. However, its major use at present is in the synthesis of ethylene glycol, an excellent antifreeze for water-cooled motors. Ethylene is also the basis for a series of important lacquer solvents. If desired, ethyl alcohol, widely used as a solvent, and also in the preparation of other compounds such as



Battery of four Holmes-Manley cracking units, with tar stripper or flashing system shown at the left. Lincoln Oil Refining Company, Robinson, Illinois

POSSIBLE UTILIZATION OF NATURAL GAS FOR THE MANUFACTURE OF CHEMICAL PRODUCTS



ether, may be prepared from ethylene. Again by the proper reaction with chlorine, ethylene chloride is formed. This is a valuable solvent, especially for fats and essential oils, and is also used as an anesthetic. Propylene finds use as an anesthetic, and also in the synthesis of isopropyl alcohol, which is being substituted for ethyl alcohol with good results in certain instances. Butylene is also used in the preparation of certain butyl alcohols which are being used as solvents in the chemical industries.

The principal liquids formed in the pyrolysis of hydrocarbon gases are benzene, toluene, and xylene. Benzene is a valuable product and forms the basis of many of our chemical processes. Thus we obtain aniline and the entire series of aniline dyes, and many explosives, perfumes, and medicinals. In addition benzene is an excellent solvent and antiknock motor fuel. Toluene is the basis of the familiar T. N. T. (trinitritoluol), of dyes, and of saccharin, a sugar substitute 400 times as sweet as sugar. Xylene is similarly used in the synthesis of dyes and other products, and also to a large extent as a solvent.

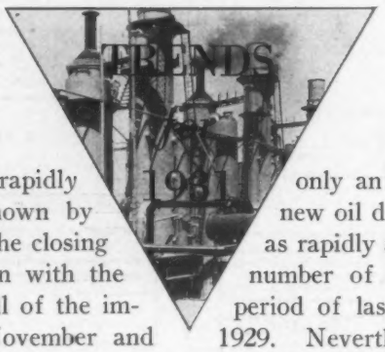
The solids resulting from pyrolysis are chiefly napthalene and anthracene. Naphthalene is well known as an insecticide in the form of moth balls. It is also the basis for the important indigo dyes. Anthracene is used in the synthesis of alizarin dyestuffs. Finally, under certain conditions of cracking we obtain carbon black, widely used in making ink, compounding rubber, and as a pigment for paint.

Chlorination is generally applied to methane, although the other gases may be chlorinated. From methane four products may be made: Methyl chloride, much used as a refrigerant; methylene chloride, a solvent; chloroform, a general anesthetic, solvent, and intermediate in the formation of other compounds, carbon tetrachloride, a solvent, used in fire extinguishers and medicinally in combatting the hook worm.

In conclusion it should be pointed out that even if the technical difficulties attendant upon the commercial production of the various products mentioned are solved, the economic side of the problem should receive serious consideration. Since, however, the raw material under consideration is virtually a waste product, any return, however small, would be profitable and an aid to conservation of our natural resources. Moreover, it has happened many times in the development of the chemical industries that the large production of a chemical product at an attractive price has stimulated its use. For example, benzene, which at present is too high in price for widespread use as an antiknock medium in motor fuel, would undoubtedly be attractive to many refineries if available at a more moderate cost. Finally, most of these processes, while they may appear simple on paper, probably will not be ready for general use for several years, as there are many technical difficulties to be solved before commercial application is feasible.

Closing Months of 1930 Reflect Improvement

By H. J. STRUTH
Staff Economist



THAT the petroleum industry is rapidly getting its house in order is shown by analysis of its salient factors for the closing months of the past year, in comparison with the same period of 1929. By assembling all of the important factors of the industry for November and expressing their relation to the preceding year by index numbers, it is apparent that numerous improvements have been made in the general statistical position of the industry. Particularly encouraging are the changes marked by gasoline imports, gasoline production, gasoline yield from crude, gasoline consumption and gasoline stocks. On a cumulative basis, however, the changes for November have had but a slight influence and the index numbers plainly show that continued curtailment is necessary to bring about a desired state of equilibrium in all departments of the industry.

Of particular interest to the refiner is the fact that a barrel of Mid-Continent, 36 gravity, crude during the 11 months ending November 30 was worth on an average of $1.24, whereas the present posted price for this grade of oil is but 95 cents a barrel. For the 11 months ending November 30, 1929, the average value of this grade of oil was $1.36, compared with an actual value during the month of November of $1.45. This means that the purchase of one barrel of this oil every day during the 11-month period would have cost the refiner a total of $413.12 during 1930, compared with a cost of $452.98 during the same period of 1929. As a matter of fact, a barrel of this oil bought every day throughout 1930 meant the expenditure of $442.57, compared with a total during 1929 of $497.93, or a net reduction in market value of such oil of $55.36 a barrel. At that rate, a refiner with a daily run of 2000 barrels was able to buy his crude for about $110,720 less than during 1929.

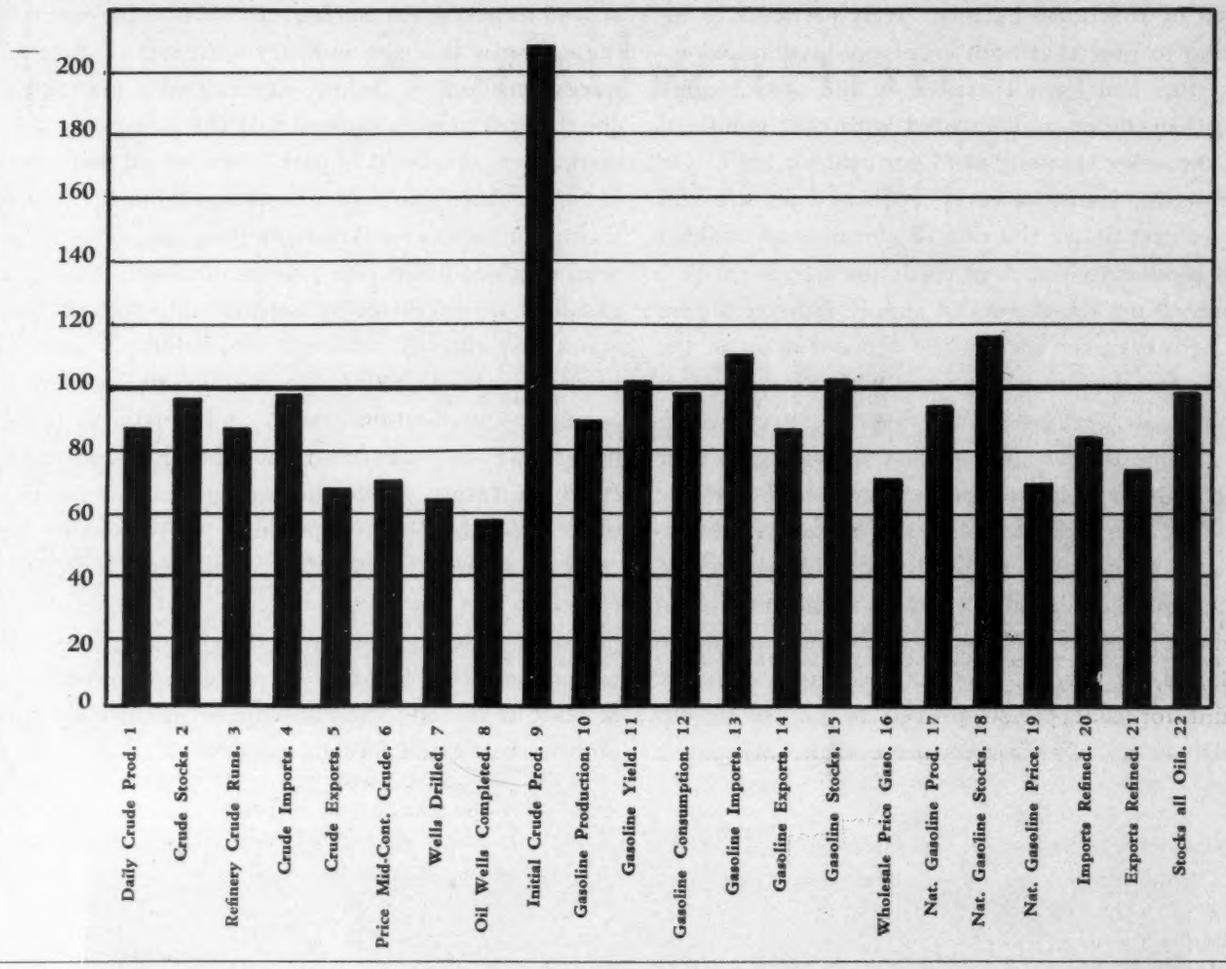
While the bar indicating initial crude oil production appears unfavorable on the chart, it is apparent that this factor cannot be construed as having a direct effect upon the supply situation. In fact, it has only an indirect effect in that the quantity of new oil developed in flush fields is being shut in as rapidly as it is found. It will be noted that the number of wells completed during the 11-month period of last year shows a decline of 3398 under 1929. Nevertheless, initial oil production increased to the extent of 3,851,000 barrels. The fact remains, however, that about 45 per cent of the new flush oil production brought in last year originated in the Oklahoma City field. Fortunately, the enormous potential production of that field is being closely guarded by the proration forces of that state. Under these conditions the prominence of the initial production bar on the chart is not of immediate consequence in the general picture.

CURTAILMENT EVIDENT

The strides made during the closing months of the past year in the curtailment of crude production and refinery runs stand out as evidence that the industry is definitely effecting a much needed balance between supply and demand. Daily average crude production for the 11-month period was down 291,000 barrels daily, while the rate of production during November shows a decline of 353,000 barrels daily under that of November, 1929. Similarly, refinery runs of

ANOTHER new feature that will answer many questions concerning the status of the petroleum industry is introduced here in the form of an "Oil Industry Barometer." It brings together many vital facts that are of especial significance in gauging the course of the industry. The comparative figures of supply and demand, field operations, prices, etc. furnish a handy reference; the index numbers place a clear interpretation upon the facts at hand, while the chart emphasizes the status of current statistics in relation to the same month of the preceding year.

Salient Oil Industry Factors for November, 1930, Expressed in Per Cent of November, 1929. Heavy Line (100) Represents November, 1929.



OIL INDUSTRY BAROMETER

Index of Salient Factors — Current and Cumulative
November, 1930

		This Month			11 Months Ending Nov. 30		
	Factors—	Last Year	This Year	Index (a)	Last Year	This Lear	Index (a)
1	Daily Average Crude Production (Thous. Bbls.)	2,625	2,272	87	2,774	2,483	90
2	Total Crude Stocks (Thous. Bbls.)	539,837	518,170	96	539,837	518,170	96
3	Refinery Crude Runs (Thous. Bbls.)	81,061	70,310	87	907,045	855,866	94
4	Crude Imports (Thous. Bbls.)	4,554	4,467	98	73,047	57,402	79
5	Crude Exports (Thous. Bbls.)	2,579	1,765	68	24,312	22,367	92
6	Posted Price 36 Gravity Mid-Continent Crude (Per Bbl.)	$1.36	$ .95	70	$1.36(b)	1.24(b)	91
7	Wells Drilled*	1,965	1,253	64	21,275	17,877	84
8	Oil Wells Completed*	1,139	644	57	12,193	9,862	81
9	Initial Crude Production* (Thous. Bbls.)	434	901	208	4,974	8,825	177
10	Gasoline Production (Thous. Bbls.)	37,700	33,616	89	401,659	407,182	101
11	Gasoline Yield—Average per cent of crude (d)	41.24	41.67	101	39.19	41.98	107
12	Domestic Gasoline Consumption (Thous. Bbls.)	31,584	30,984	98	348,818	366,466	105
13	Gasoline Imports (Thous. Bbls.)	984	1,079	110	8,118	15,963	197
14	Gasoline Exports (Thous. Bbls.)	4,219	3,690	87	56,054	61,235	109
15	Gasoline Stocks at Refineries (Thous. Bbls.)	37,997	38,705	102	37,997	38,705	102
16	Refinery Price U. S. Motor Gasoline, Group 3 (Cents)	7½	5 1/3	71	7⅞(c)	6½(c)	83
17	Natural Gasoline Production (Thous. Bbls.)	4,504	4,238	94	47,814	47,538	99
18	Natural Gasoline Stocks (Thous. Bbls.)	514	596	116	514	596	116
19	Price Grade "A" Natural Gasoline, Group 3 (Cents)	6½	4½	69	7¼(c)	5½(c)	76
20	Imports of all Refined Oils (Thous. Bbls.)	3,327	2,807	84	27,374	40,176	147
21	Exports of all Refined Oils (Thous. Bbls.)	10,565	7,776	74	124,398	123,231	99
22	Total Stocks of all Oils (Thous. Bbls.)	685,708	672,806	98	685,708	672,806	98
	Weighted Index of Supply	.....	.....	107	.....	.....	117
	Weighted Index of Demand	.....	.....	83	.....	.....	100
	Weighted Index of Prices	.....	.....	70	.....	.....	91

*Exclusive of Rocky Mountain area.
(a)—Last Year—100
(b)—Weighted Average.
(c)—Monthly Average.
(d)—Straight run and cracked gasoline only.

crude have been curtailed to the extent of 51,179,000 barrels during the 11-month period, while the month of November shows a decline under the same month of 1929 of 10,751,000 barrels. It is particularly interesting to note that both crude production and refinery runs had been curtailed to the same degree during November, as compared with that month of 1929; the index standing at 87 per cent for both. On a cumulative basis, however, refinery runs are still four per cent above the rate of curtailment attained by the producing branch of the industry.

Summed up, the factors of supply indicate a gain of 17 per cent over 1929, while demand is about the same as for the preceding year, with the price factors nine per cent below the rates in effect during 1929. Domestic gasoline demand shows a gain over 1929 of only five per cent, but reference to the March, 1930, THE REFINER AND NATURAL GASOLINE MANUFACTURER, wherein the writer presented his estimate of the 1930 gasoline demand, shows that the anticipated demand for the first 11 months of the year amounted to 364,489,000 barrels, whereas the actual domestic demand for that period proved to be 366,466,000 barrels, or 1,977,000 barrels more than anticipated. On the other hand, the writer estimated a total gasoline demand, including exports, of 434,184,000 barrels for that period, whereas the actual demand proved to be 427,701,000 barrels. It is apparent from these figures that the industry's exports of gasoline were considerably below expectations, and subsequent developments showed that the foreign gasoline market was displaced in part by increased shipments of South American and Russian gasoline to former European outlets for American gasoline. This situation, combined with the receipt of South American gasoline in excessive quantities into the United States has directly affected the industry's gasoline supply situation during the past year. In view of conditions in South America and Russia it is believed that our crude exports will become even smaller in the future, while the foreign market for gasoline and other refined products will probably become increasingly difficult to maintain. It is seen, therefore that American producers and refiners must maintain close vigilance over their production schedules during 1931 in order to prevent the production of more than actual and anticipated requirements of both domestic and foreign markets.

Shell Oil Company and Richfield Oil Company plants at Watson Junction, California

Oklahoma City Crude Stabilization

By JOHN C. ALBRIGHT

IN the Oklahoma City field much of the crude oil is of an unusual high gravity which indicates a very high percentage of gasoline. Indian Territory Illuminating Oil Company, being cognizant of this fact, is taking advantage of an unusual situation by processing this high gravity crude through one of the most unusual skimming plants in the Mid-Continent.

Not satisfied with squeezing out all of the marketable fractions of the casinghead gas, and the gas from the lift stations, company engineers consulted with the engineers of Tulsa Boiler & Machinery Company, Tulsa and from the ideas born in this manner, have adapted one of the traits of the packing house operators — they are utilizing everything but the smell, and fortunately, in this field, that smell is somewhat agreeable, especially in comparison with smells arising from the processing of West Texas and New Mexico crude.

A refinery* has been evolved with a maximum capacity of 10,000 barrels of Oklahoma City crude during each 24 hours of continuous operations, and a pipe still flashing tower and a chemical treating unit have been assembled. The crude oil charging stock is received by the plant directly, and perferably from their highest gravity oil wells, into a battery of 10,-000-barrel tanks, which have been built in close proximity to the processing plant. The higher the gravity, the better, of course, for the plant process. Some of the wells are "near" gasoline, occasionally going to above 60° API. The bulk of the crude processed is in the 50s, and when processed, the residium, or still bottoms, is pipe line oil in the upper 30s.

PROCESS DETAILS

This high gravity crude oil is taken from the storage tanks through an electric, motor-driven, Goulds centrifugal pump, to an especially constructed "Tulsa Type" heat exchanger, mounted on a conventional structural steel rack. This exchanger consists of six sections of 12½-inch pipe, containing 112 ½-inch tubes. The flow from the heat exchanger is through three sections of pre-heaters or "pipe still", built in the same manner as the heat exchanger, and superimposed upon it—all carried on the same tower. Here the oil receives its first application of heat, other than that transmitted in the heat exchanger. From the pre-heaters, the oil is sent to the stills, or flashing tower. These stills are two "Tulsa Type" gasoline plant absorption towers, 10 trays each, with manholes built integral with the towers. Company officials decided upon this style of tower, with the idea in mind that upon some future contingency they could be salvaged and placed in the regular equipment for natural gasoline manufacture.

The oil enters these towers over the second or fourth tray, counting up. Refluxing is obtained by a split stream, going over the eighth tray from the bottom, condensing, or rather absorbing the heavier ends, and carrying them with it on its downward journey over the several plates to the bottom compartment. In this bottom compartment there are two heating elements (conventional steam heaters). The desirable gasoline vapors are driven out of the crude oil, partly by preheaters, or "pipe still", before entry in to the "flash towers", and finally by the tubular heating elements in the bottom compartment of the towers. The flow of the oil and the temperature of the bottom compartment are synchronized and controlled by recording thermostats.

Heat for the distillation apparatus is generated in seven 125 horsepower, 250 pound working pressure Kewanee oil-field-type boilers. Only a small portion of this steam generated in this manner is used in the skimming plant. Exhaust steam is utilized from a pair of General Electric turbine driven generators. This exhaust steam is reheated by live steam from the boilers in a conventional super-heater. The still bottoms or residium from the bottom compartments of the towers, flows through float controlled valves to the heat exchanger where it gives up a greater portion of its heat acquired in the towers. From these heat exchangers, (coolers in this stage of the process), oil flows through manually controlled manifolds, where it is directed to the proper storage tank, and is then pipe line oil of sufficient gravity to command the top price as posted by the pipe line companies.

Only two cuts are made in this process—68/70 aviation gasoline of domestic grade, and pipe line oil free from b.s. or any foreign matter. The aviation cut is taken from the top of the towers. The vapors

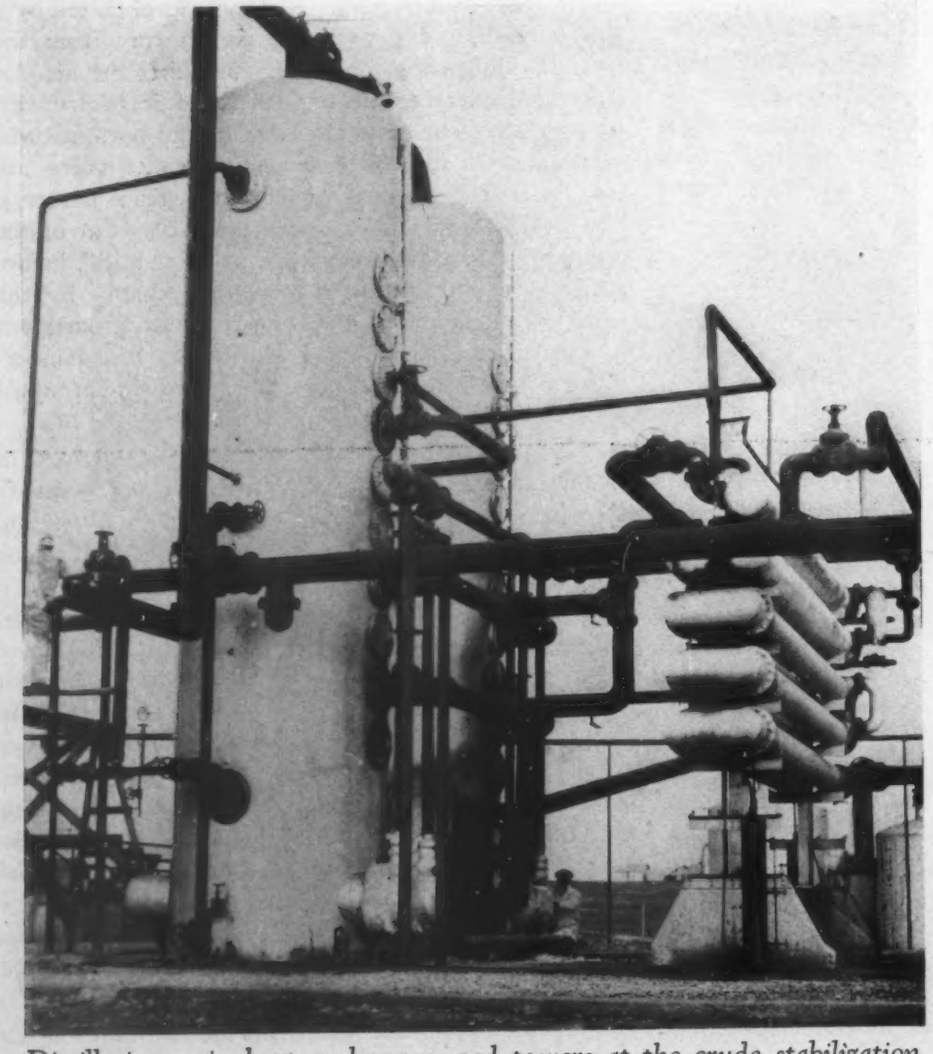
*See Refiner and Natural Gasoline Manufacturer—"Gasoline Plant Methods at Oklahoma City"—George Reid. Issue of July, 1930, page 67, and issue of November, 1930, page 160—"Crude Stabilizing Unit."

from the top of these towers are led through a six inch line, carried on pipe stanchions, to the condensers.

OPERATING PROBLEMS

These condensers are Griscomb-Russell Bentube sections of the atmospheric type, placed in a Fluor tower and inverted; that is, the flow enters the bottom of the battery, and flows upward. Occassionally a little difficulty is encountered in condensing all of the vapors coming from these stills, adapted from absorbers. This difficulty arises from the fact that most of the high gravity crude oil being processed is extremely fresh and being produced under rather high pressure, acts as a very good solvent for the butanes, both normal and iso-butane. Occassionally, a small percentage of propane is dissolved in the oil. Ordinarily a very slight gage pressure is carried on these condensing sections, principally to allow the lower boiling fractions to pass through uncondensed.

The gasoline from these condensers is received in a horizontal run, or accumulator tank, which has a section of steam coil built into the bottom of it. A thermostatically controlled steam valve is placed in this steam coil section to enable the operators to carry exactly the predetermined temperature on the gasoline in this accumulator tank. This is where the salvaging of the "squeal" comes in: the uncondensed vapors, and those driven off the gasoline, are carried through a vapor line to the compressors of the gasoline plant, which is built on the same lot upon which this skimming plant is operating. Only once in the normal operation of this unusual skimming plant has any gasoline been produced which was off color. In this instance, the float from the outlet of the stills or "flash" towers stuck closed, allowing the charging stock to fill the stills and consequently ran over into the condensers, off coloring the entire system.



Distillation unit, heat exchangers and towers at the crude stabilization plant operated by Indian Territory Illuminating Oil Company, in the Oklahoma City field.

TREATING

The gasoline leaving the accumulator, or run tank, is domestic aviation, and is non-corrosive to the copper strip, and just sour enough to fleck the sulphur in the doctor test. A continuous sodium hypochlorite treating system is in service. An elevated caustic mixing tank is partly filled with water, then a drum of caustic is steamed into it. This solution is dropped into the chlorinator, where a drum of liquid chlorine is allowed to empty into it through a submerged tube. The entire batch of sodium hypochlorite is pressured into the treating tower, or "agitator," where the gasoline is allowed to percolate through. As soon as the gasoline shows a tendency to become sour on the outlet of the treater, the batch of treating solution is transferred back to the chlorinator, and re-chlorinated. When spent the second time, the solution is then drawn off to the caustic pit, and discarded.

The cost of treating this gasoline is between 1½ and two cents per 1000 gallons of condensate. This finished product, sweet to the doctor test, and non-corrosive, 30 plus color, being of an average gravity of 68.5° API, is then run to storage. At one time the company had several hundred thousand gallons of this premium

gasoline in storage. Now, evidently the demand is greater, and the product is loaded into waiting tank cars. Only four men are required to operate this plant of 10,000 barrels maximum capacity; three stillmen and a plant supervisor.

Wirt Franklin Plant Made From Surplus Material

WHEN the revised prices for crude eliminated gravities above 41° A. P. I., and some of the pipe line companies even balked at an offer for sale of Oklahoma City's 70 gravity crude, the addition of this kind of crude petroleum to the production that is already above the required gravity, did not ease the situation already existing in this field.

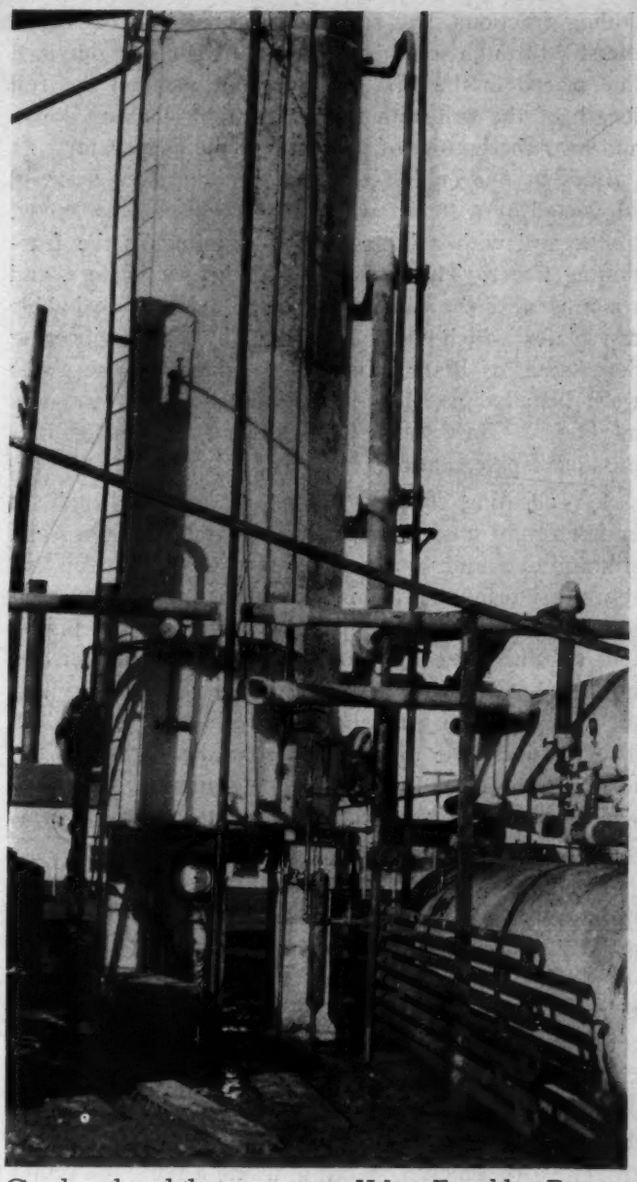
Wirt Franklin Petroleum Corporation with a number of wells that produce oil of a gravity above the average, and some producing the crude that is pretty near gasoline at the separator, the company had a situation that demanded some kind of action to keep that class of oil from piling up in storage.

This company has a refinery at Ardmore, which, like all refineries, has several pieces of equipment that had either become obsolete, or were classed as surplus stores. Officials decided to utilize some of this surplus material in the construction of two rectification plants to take care of this high gravity production. Company engineers selected enough material from these surplus stores to build these plants, without the necessity of purchasing new material in appreciable quantities.

One of these units is built on a space that was more or less wasted. Utilizing a plot of ground between the boiler room and the louvre tower of the gasoline plant, it takes up very little room, is not complicated in design, is compact, and requires very little of the time of the gasoline plant operator in operating.

The wells that Wirt Franklin Petroleum Corporation own and operate in Trosper Park and that vicinity, which produce this high gravity petroleum, are governed by the same rules that apply to the wells that produce the lower gravity oils. When the alloted time arrives for flowing of wells producing oil of a gravity around 70° A. P. I., the production is handled through separate lead lines, and placed in separate storage from the production of the lower gravity wells on the leases. This production is gauged in the same manner as is all other production; and of course regardless of gravity, it is credited to the respective leases from which it is produced.

The other rectification unit is built on the site with the company's Lowery gasoline plant, and does not require any more room than the one at Trosper Park.



Crude oil stabilizing unit at Wirt Franklin Petroleum Company's Lowery Gasoline Plant, Oklahoma City field.

It is a little more complicated, and is more elaborate in design, but does not require an additional operator; and the regular gasoline plant operators take care of the unit.

TROSPER PARK PLANT

The rectification plant at the Trosper gasoline plant has a still or evaporator, built of a horizontal shell five feet in diameter and 40 feet long, which is placed on a concrete foundation and is insulated throughout. Within the shell of this still is a steam heating element built of a series of two-inch pipe coils. A thermostatically controlled valve is placed in the steam line leading to the coils in this shell, and admits only as much steam as is necessary to maintain the temperature needed to vaporize the desired percentage of the lighter fractions of the oil in process. To accelerate the separation of the lower

boiling fractions, live steam is injected into the oil in the still through small perforations drilled in a one-inch line placed in the still. This line is installed the full length of the still with the perforations looking down, and near the bottom of the shell of the evaporator.

Built at one end of this still superimposed upon it, supported by a steel tower construction, and connected to the still with a large flanged coupling, is the fractioning tower. This tower is five feet by 16 feet, and contains near the top, in the upper half, three bubble cap plates which were fabricated by the engineering department of Black, Sivalls and Bryson. These plates were installed on the ground by the company's own mechanics. The object of this tower is both fractionating and dephlegmating.

A preheating element, about 100 feet in length, is built at right angles to the still, beginning at the shell still and extending to the boiler feed water hot well and returning to the still. This preheater is made of several joints of four-inch line pipe with a two-inch line inside. One two-inch extends through the first section over and into the hot well tank, and carries the exhaust steam of the pumps—condensing the steam and heating the oil. The two-inch line through the second section also extends through the four-inch, and terminates at the hot well tank, carrying the condensed water from the heating coils in the still.

The oil is pumped through the first section, returning through the second section of the preheater, and enters the still on the upper side, and near the end upon which is placed the fractionating tower. Flowing slowly through the still, it comes in contact with the heating coils, and with agitation from the live steam releases about 90 per cent of its volume into gasoline vapors. The oil level is maintained a little more than half the depth of the still, leaving through a liquid level controlled valve which is placed in a line leaving the center of the end of the still. This residue leaving the still is carried at or near 37 gravity A. P. I., and is pumped into storage on the plant ground, afterwards being blended with other production of the leases; and is pipe line oil.

Vapors leaving the shell of the evaporator, flow back and upward through the fractionating tower, where the heavy ends back trap through the bottom of the tower into the shell. The fractionated vapors leaving the tower are carried through a vapor line to the cooling tower of the gasoline plant, where they are condensed in a battery of Griscomb-Russell Bentube sections. The condensate leaving these condensers, is received in a conventional accumulator tank, and is trapped from this tank to plant storage.

THE FRACTIONATING TOWER

The fractionating tower is controlled by gasoline reflux, pumped from the accumulator tank back to the tower, and enters near the top. A thermostatically controlled valve admits only the amount of reflux that, by experiment has been found necessary to control the end point of the condensate. The gasoline manufactured by this installation is remarkably stable, having only a very small percentage of butane, and is usually around 70/72 gravity having a recovery of 96/97 by Engler distillation. Uusally the production from this crude oil distillation unit is used to blend with the higher gravity more volatile production of the gasoline plant.

The normal throughput of this unit is 1000 barrels of oil daily; continuous distillation is carried out when in operation; when the controls have been set at the desired points, the unit requires no further attention.

The rectification plant at the Lowery gasoline plant, consists of three major factors, or pieces of equipment: the combination vaporizer-heater; the dephlegmating-flashtower-fractionator, and the condensers. The vaporizer-heater is a horizontal shell, four by 16 feet, placed on a low concrete foundation. Within this shell are a series of two-inch pipe coils carrying live steam directly from the gasoline plant boilers for heating the oil to the required temperature. Built directly above, and extending the full length of the still, is a steam heated superheater.

The oil is pumped into the shell of the still, which is carried full and is discharged into the superheater, thence to the vertical dephlegmating-flashtower-fractionator. All charging stock leaving the superheater, enters the vertical tower near the middle and flows down over a series of bubble cap plates, and down to the bottom section, where live steam is injected into the oil to complete separation of the vapors from the oil. This oil is of the same general characteristics of that being processed at the Trosper Park plant, and the residue is discharged at a gravity of near 37° A. P. I.

The vapors travel upward through the tower, and are discharged through a short vapor line to the condensers. These are conventional two-inch pipe coils placed in a salvaged refinery condenser box, and are of the submerged type. The condensate leaving the submerged coils, flows through two water legs, which effects separation of the water from the gasoline before it is received in the run or accumulator tank. Reflux is obtained by pumping a stream of this gasoline back over the tower through a thermostatically controlled valve placed in the reflux line at the top of the tower.

The production from this unit is used to blend the high gravity gasoline production down to grade AA, having a gravity sufficiently low enough, and a recovery high enough to be admirably suited for this purpose.

Water for the condenser box is produced from a well adjacent to this rectifying unit; and the surplus is run from the condenser box to the cooling tower of the gasoline plant.

Experimental Cracking Unit Has Interesting Features

By BRAD MILLS
Staff Representative

NEWS items have appeared from time to time in the trade press concerning the experimental work of the Hoge Process & Refining Company, at Taft, California. In line with the Policy of THE REFINER AND NATURAL GASOLINE MANUFACTURER *to report to its readers as much of the details of new processes and developments as is possible to secure, Mr. Mills of the Los Angeles office was requested to prepare the accompanying discussion of the Hoge process. Some interesting innovations in design are reported in service in this experimental installation.*

DEVELOPMENT of a new refining proccc which may be installed in any refinery as the last phase in the line, or may be used for raising the gravity of low grade crude oil, has been announced by a small group of engineers and financial interests at Taft, California, where a small experimental plant has been built to test various grades of San Joaquin Valley crude and fuel oil. In fairness to all interests concerned, it might be well to mention in the beginning that opinions of leading refinery engineers differ on the importance of the new process. Experimental runs have been made in the presence of representatives of leading companies and results carefullv checked, however.

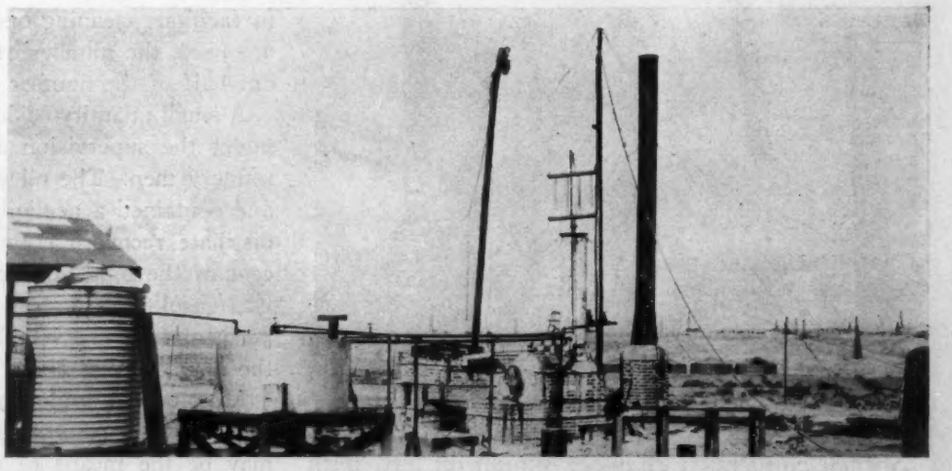
Special features claimed for the process are low operating pressures, high temperatures and low initial cost and upkeep. Simplicity in design is outstanding although the special cracker, or conversion chamber, employs principles not in use in any other type.

While assertedly designed primarily to aid refiners who have not been able to operate profitably on heavy oil, the process seems to hold much promise for converting the heavy crude into a lighter product. Claims that this conversion may be accomplished without sacrificing other essential qualities are made. Test runs resulted in obtaining a much lighter product from very heavy crudes. The process for raising the gravity of oil is essentially the same as that used for obtaining a high gasoline yield, but fractionation and special cooling are not required. The vapors are taken directly from the cracker to the condenser to obtain the lighter products.

Much of the process is carried out through what might be termed standard equipment, the heart of the system being the special conversion chamber or cracker.

Due to an improvised cooling and condensing system, results of test runs probably would have been much more satisfactory had a more elaborate cooling installation been made. As now operated the installation consists chiefly of a small still, the special channel conversion chamber, carbon trap, fractionator, aerial cooler and coil condenser.

The oil is pumped or sent by gravity to the still and heated to a temperature of 600-800° F. when the process is to be used for cracking or conversion. The still valve opens at the oil vaporizing temperature under two pounds pressure, permitting the vapors to pass through the pre-heating tubes in contact with the flues. The temperature of the vapors is further raised to an intermediate point between that maintained in the still and the conversion chamber. The vapors enter the flat

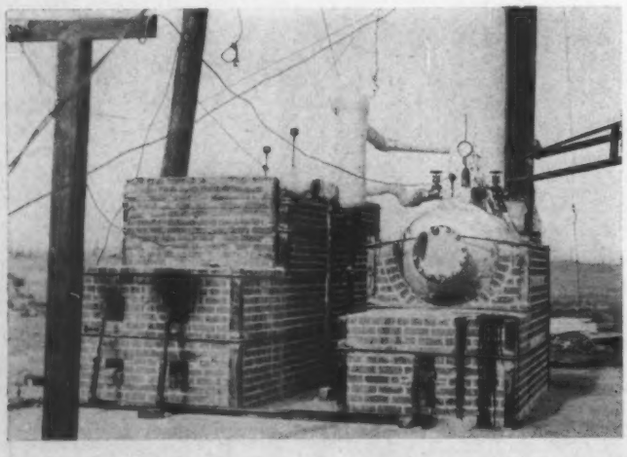


Experimental plant of Hoge Process & Refining Company

cracker or conversion chamber at one corner and work their way through it, leaving at the diagonal corner. They then pass through a carbon trap, the fractionator, aerial cooler and finally to the condenser. The resulting distillate on actual test runs contained up to 95 per cent gasoline.

The special conversion chamber resembles a flat steel box and is constructed to obtain a new effect upon the vapors in their course through it. A series of 12 baffles, each running from one side to a point a short distance from the other side and staggered to obtain the desired effect, divide the chamber into 13 narrow channels, each obviously running the full length of the box. The end of each baffle plate is finely notched to break up the flow of the vapors, which must pass the full length of the chamber 13 times before leaving it at the diagonal corner. The flow is naturally in alternate directions during its progress from one channel to another. Meanwhile a temperature of 1000-1250° F. is maintained in the chamber to change the nature of the original oil.

One of the most important installations within the conversion chamber is a series of small perforated pipes running across the steel box at right angles to the baffle plates and flow of the vapors. Ordinary gases, chemicals or even hydrogen might be introduced into the cracker through this small perforated pipe circuit, which starts at the main point of entry of the vapors, crosses it five times to obtain a spraying action throughout the box, and leaves it at the main exit of the vapors. The line supplying this small perforated series of lines within the chamber runs inside the main flow line carrying the vapors from the still to the cracker and also inside the pre-heating tubes in contact with the flues. In introducing gas or a chemical into the chamber through the perforated lines, enough volume is furnished to build up a low pressure the full length of the perforated line. The small perforations will allow the gas to escape from the moment it enters the chamber, but a small line pressure will eventually be built up and the perforations near the point of exit will give off practically as much gas as those near the point of entry.



Special conversion chamber shown on left, with still and part of fractionator on right.

The combined vapors pass off and go through the remainder of the system as previously described.

To raise the gravity of oil, the process is the same until the vapors have passed the carbon trap. From this point they are taken directly to the condensers, the need for fractionization obviously being eliminated. During the process of conversion, certain crudes may require slightly different treatment. The temperatures in the still and cracker, as well as the action of the perforated cross lines within the cracker, may vary from runs where a maximum gasoline recovery is desired. Complete vaporization is necessary in the still, followed by the much higher temperature in the conversion chamber, or cracker.

A valve for topping is connected at the top of the still and leads directly to the condenser.

Use of the first dry gas obtained for fuel to run the plant reduces the operating cost materially. On the first cycles, this gas is connected to the regular fuel supply and enough is obtained to maintain proper temperatures. Much of this gas is normally useless, except for fuel.

Refinery engineers who have studied the construction of the cracker admit the installation holds possibilities, in that the introduction of steam, gases or various chemicals is admittedly good practice under certain conditions. While the Hoge Process and Refining Company, owners of the new process, does not make broad claims for steam as a spraying or conversion medium, the introduction of steam under certain conditions might check the formation of carbon.

The time element and the speed of the vapors in the cracking unit are important factors in the process, an average speed of 900 feet per minute being maintained. Claims that this treatment results in a gasoline with a minimum sulphur content and definite anti-knock qualities are made. The distillate recovered may be treated according to accepted refinery practices.

The free gasoline and water are drawn off while the heavier oil is being heated to the vaporization point. Thereafter the valve leading to the cracker is opened and the vapors pass through as previously described. Large opening at either end of the cracker are provided to facilitate cleaning operations. Ordinary screw plugs are used, the number of opening on each end totalling one-half of the number of channels.

A small quantity of Mt. Poso crude was recently run under the supervision and observation of experienced refinery men. The oil when received was 15.8 gravity and contained a negligible percentage of gasoline. The distillate recovery with the process was a full 90 per cent of the total oil run, of which 90 per cent in turn was gasoline, making a gasoline recovery of about 80 per cent from the very heavy crude oil. The gravity of the distillate was about 43 degrees.

Most of the crude produced in Kern County falls in the heavy oil column, and for this reason the process may be the means of assisting producers to compete with districts yielding lighter crudes.

Modernize Cat Canyon Refinery

By BRAD MILLS
Staff Representative

THE remodeling of an old refinery in the Cat Canyon field by Gilmore Oil Company to handle the very heavy crude produced in this district illustrates the value of a modernization process where plants have become obsolete or have ceased to return a fair profit because of competitive conditions. Originally built more than 15 years ago, the plant was designed to handle a very heavy crude according to the accepted methods of that day, but the steady improvement in refining processes rendered much of the equipment obsolete and virtually forced the installation of a more modern process. Lack of control over the finished products indicated the need of an automatic layout and extensive repairs.

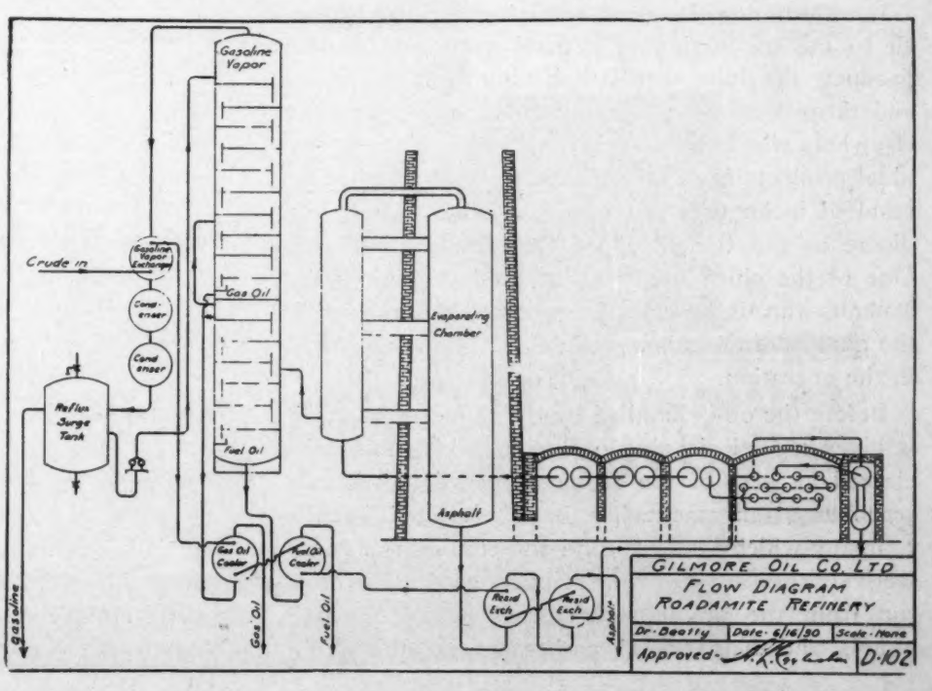
The original equipment included an old type Trumble distilling plant, evaporating column, condensing system, continuous acid treating plant, besides the customary cooling equipment, heat exchangers, boilers, tanks and smaller equipment. The distillation plant comprised a tubular heating retort which functioned fairly well under average conditions.

During the early life of the old refinery, market needs differed from those of the present day. The four products made and marketed were white distillate, a black distillate, 70 road oil and 90 road oil. The refining process was continuous, the chief demand on the plant calling for a generous supply of both grades of road oil. The remaining products were marketed chiefly as by-products. The plant handled up to 1000 barrels daily in its way, with whatever degree of efficiency the operators could muster and with no definite control in some respects.

A study of the crude produced in the Cat Canyon field causes the average operator to wonder why at refinery of any kind should have been built here in the first place. The crude varies from eight to 14 gravity and, besides being extremely viscous, contains a high percentage of water and sand. Its value for making road oil is widely known, however, and it was possible to operate profitably because of this quality—at least under competitive conditions of several years ago.

Early production methods were awkward, as the oil was pumped from the wells and allowed to flow through open ditches to sumps and tanks. Tests showed the heavy crude to contain up to 11 per cent gasoline at the well, but careless handling dissipated much of this commodity. Such a high gasoline content was unusual for a crude of this nature. Oil reaching the refinery was from 12 to 14 gravity and contained up to 45 per cent water, besides a generous quality of sand. Following the dehydration process, the crude contained about five per cent gasoline, 14-16 per cent gas oil, 14-16 per cent lube distillate and 58-62 per cent 40 penetration asphalt. Under average conditions about three per cent of white distillate or naphtha was produced, in addition to 25 per cent of dark distillate and 70-75 per cent road oil.

Although the refinery served an early purpose well,



a study of results disclosed the necessity for improvement. Poor handling of the crude was reducing the gasoline recovery, while the process was throwing much of the dark distillate into the supposedly white distillate, failing to make the proper separation. The finished products were acceptable 10 years ago but failed to meet the exacting requirements of the present day specifications.

When Gilmore Oil Company took over the old refinery late in 1929, plans were immediately drawn for remodeling the layout. There was a ready market for finished products refined properly, with a good supply of Cat Canyon crude available. Besides the various grades of road oil and asphalt, gasoline, gas oil and fuel oil could be made in paying quantities with the proper equipment.

MODIFICATION REQUIRED

A survey of the plant by H. L. Eggleston, refinery superintendent for Gilmore Oil Company, revealed the necessity for many changes, although it was evident that most of the old equipment could be used if repaired or re-arranged. The condensers, heat exchangers, cooling equipment, heating retort, treating plant, boilers and smaller equipment for the greater part needed attention but could be restored to service after necessary repairs and additions. It was obvious that the new equipment should include a fractionating column for proper separation of gasoline, gas oil and fuel oil, in addition to some type of automatic control arrangement.

Additions and repairs to the original layout necessitated changes in the flow arrangement. Extensive repairs were made on the retort, coolers and condensers, while an improvement in the retort and separating chamber facilitated the manufacture of uniform asphalts and road oils.

In redesigning the plant, special attention was given to the production of a good grade of residual product, the lube distillate having been sacrificed and thrown over into fuel oil. A common practice elsewhere was to produce asphalt and road oil as residual products from lube plants, this practice having resulted in an excellent grade of lube oil and mediocre or questionable grades of residual asphalts. One of the chief aims was to produce high grade asphalts through a specific process design, even if the quality of the other products had to be sacrificed in the operation.

Before the oil is handled by the refinery proper, it is given a final cleaning operation, which might be classed as part of the refinery operation. A new scrubber arrangement has been perfected by the company which removes sand and emulsion more effectively than any device previously used. The oil is run from the preliminary storage tanks, through pumps, and then through preheaters into the scrubber or dehydrator, a pressure of 15 pounds being held. The oil then passes to another settling tank before going to the stills. The b.s. & w. cut is often reduced from 50 per cent to three per cent by the preliminary operation.

Despite the nature of the oil, the flow sheet does not differ materially from the usual crude oil distillation plant flow chart. Pumps sending the crude from the flow tanks are controlled by an air actuated flow controller, the oil going to a gasoline cooler and condenser and being raised to a temperature of 220 degrees F. The crude then passes through the scrubber or water separator described in the previous paragraph.

From the water separator the crude goes to the residue exchangers, the temperature being raised by the hot residuum. The oil then passes through a double series of tubes which include first a series of 13, four-inch by 19-foot tubes and a series of six 10-inch by 19-foot tubes, the latter being equipped with steam sprays. The oil enters the asphalt evaporator for removal of all products not wanted in the finished bottoms. This part of the operation is important and in the chamber full control is maintained over the steps that make possible the high quality of the finished runs. The bottoms from the asphalt evaporator pass through the crude-residuum heat exchangers, with a reduction in temperature to 280 degrees F. before passing to storage.

From the evaporating chamber the vapors are sent to the fractionating column. Here three cuts are taken, with gasoline, gas oil and fuel oil coming off successively. The fuel oil is similar to lube distillate but does not fall uniformly within this classification. The vapor fractionating column permits overhead, bottom, and side cuts and is not a wide departure from the usual type of fractionator. Some kerosene is present but it is combined with the gas oil.

The automatic control arrangement includes flow controllers, liquid controllers and temperature controllers, all of which are air actuated. Foxboro controllers and Neilan valves are used, while Morey, Jones and Lovell type indicating differential manometers are employed as flow indicators on process steam lines. The float levels were furnished by Schand and Jurs. The new fractionating column was installed by Southwestern Engineering Corporation.

In addition to plant improvements, a heating plant for the residual products, treating plant for gasoline, and facilities for loading and transporting the finished products, were provided.

The daily throughput is less than 1000 barrels; and the profitable operation of a refinery on such a small quantity of extremely heavy oil is considered a real achievement.

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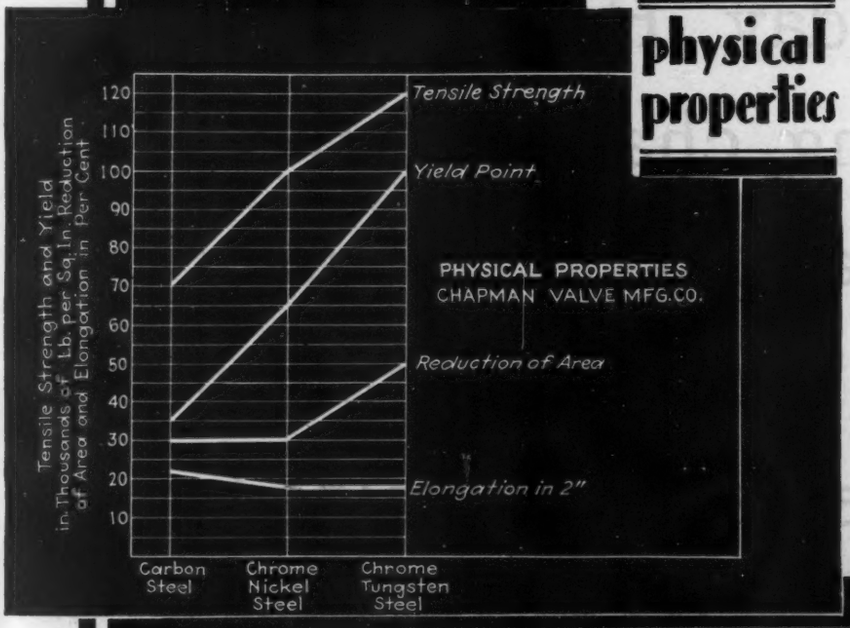

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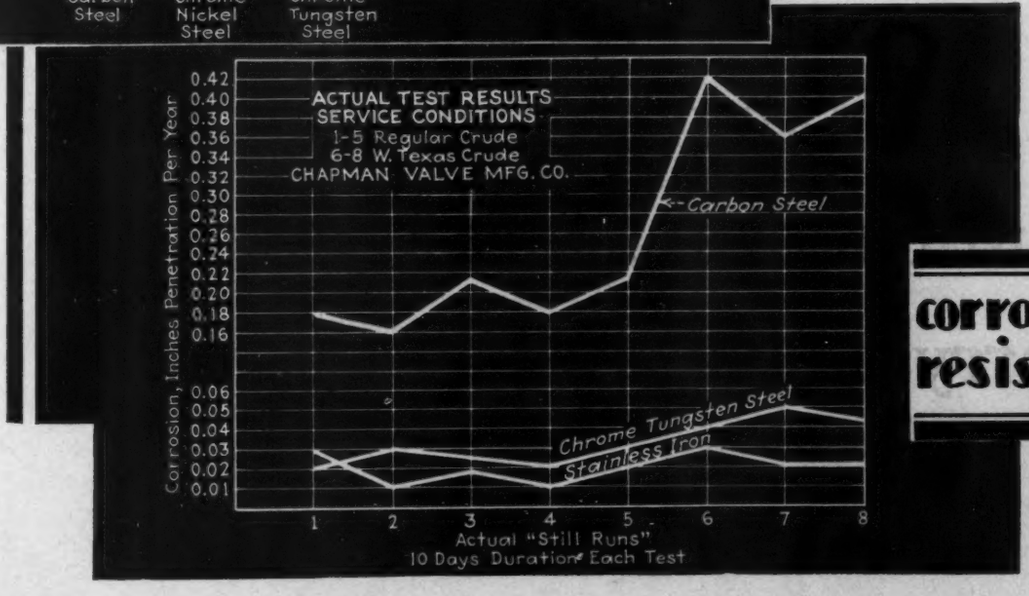

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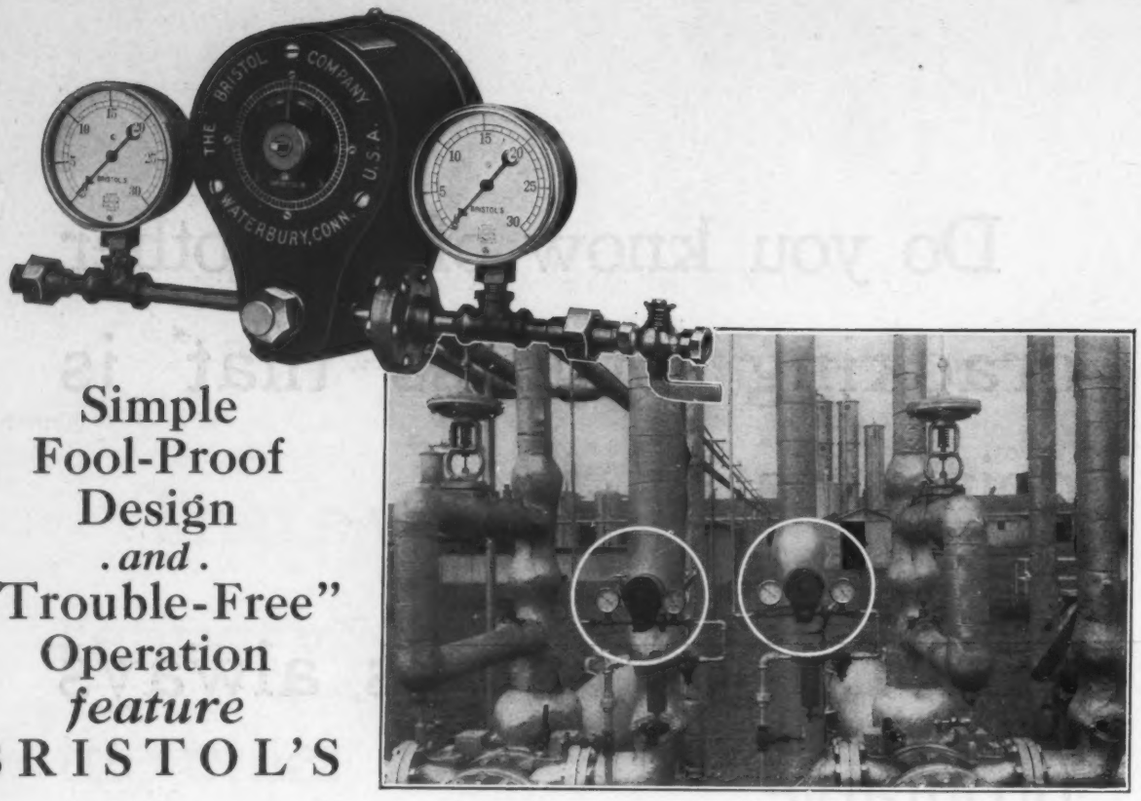

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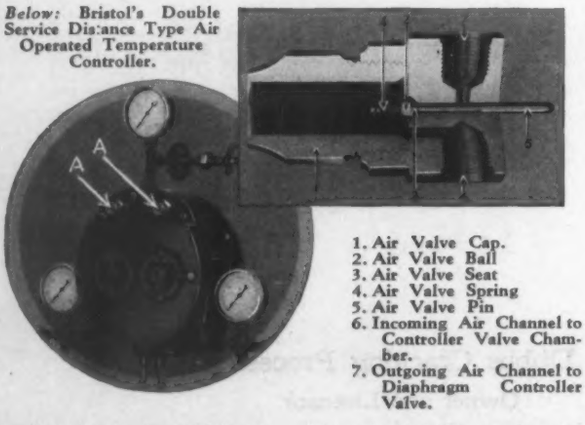
Sectional view shows simple trouble-free design of Air Valve in Bristol's Controllers

Below: Bristol's Double Service Distance Type Air Operated Temperature Controller.



1. Air Valve Cap.
2. Air Valve Ball
3. Air Valve Seat
4. Air Valve Spring
5. Air Valve Pin
6. Incoming Air Channel to Controller Valve Chamber.
7. Outgoing Air Channel to Diaphragm Controller Valve.

A distinctive feature which has done much to establish the fine record of Bristol's Air Operated Controllers is the simple design, rugged construction and accessibility of the Controller Air Valve. As shown above at (AA), the Controller Air Valve Cap extends thru front of instrument case; readily accessible for inspection, cleaning, replacement or interchanging.

To remove, unscrew air valve cap (A or A) and lift out air valve (2) with spring (4) attached. The Valve seat (3) is then exposed, almost flush with front of instrument case.

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Instruments *for* Indicating Recording Controlling

Guarding Cracking Operations From Accidents

By E. M. MATSON

ARTICLE I
Analyzing the Problem

A CRACKING plant can be operated as safely as any other type of distillation equipment; and it is poor business not to operate it that way. Refiners more and more are realizing this as the importance of cracking in the refining scheme becomes greater.

The potential hazards are due to the fact that cracking equipment is operated at high temperature and pressure. There are three reasons for the greatest vigilance and care in cracking operations. They are: saving of men from death or injury; preventing destruction of property; and preventing loss of profits through plant shutdowns. The first step to be taken in establishing safe operating procedure in a refinery is to make a comprehensive analysis of the hazards to be met.

Unless safety measures are devised or designed to eliminate or control specific potential dangers, the completeness of the safety measures as a whole may be seriously questioned. It is imperative that a thorough understanding be had of all phases of operation and equipment before applying or adopting safety measures.

There are several ways of viewing refinery operating hazards, but, broadly speaking, they may be divided as follows, viz:

(a) Those hazards that may be eliminated entirely by proper arrangement and character of equipment and proper methods of operation.

(b) Those hazards that cannot be altogether eliminated but may be controlled.

(c) Those hazards that develop as a result of depreciated or defective equipment.

(d) Unexpected hazards.

Before applying any measures for elimination or control of danger, it is vitally important to know what the inherent dangers are; that is, those that exist because of the nature of the stock being cracked and the temperatures and pressures of the operation.

It should always be borne in mind that inflammable liquids are being handled in a cracking plant. Heavy fuel oil does not vaporize so easily as naphtha or gasoline, but does, nevertheless, present a fire hazard. As long as everything goes well, the fire danger is controlled absolutely by the handling of these inflammable liquids in tight tanks and pipes. However, there is always the possibility of a leak which may spell serious trouble.

Petroleum products do not lend themselves to the same fire-control as do combustible solids. Combustible solids at least "stay put."

Light oil can quickly vaporize and form an explosive

E. M. MATSON

THIS constitutes the first of a series of articles having to do with the safe operation of pressure plant or cracking equipment, written for THE REFINER AND NATURAL GASOLINE MANUFACTURER *by E. M. Matson, safety engineer, service department, Universal Oil Products Company.*

This series of discussions has as its purpose the presentation of information directly applicable to all types of cracking processes and they will treat with such hazards as those arising from water, corrosive conditions, vapors, and the human element. Further, the means of reducing or eliminating such hazards will be discussed.

E. M. Matson, the author, dates the start of his cracking plant experience back in 1920. This experience includes design, construction and operation of cracking units. During the past several years his efforts have been directed primarily toward accident prevention in the operation of cracking equipment. His work now places him in charge of inspection service rendered to Dubbs licensees in this and foreign countries.

24 POINTS OF STRENGTH

Twenty-four nozzles were required in this SMITHWelded Chamber. The natural weakening effect of these openings is entirely offset by the reinforcements designed by Smith Engineers and applied by SMITHWelding.

Here is an example of the value of Smith Pressure Vessel design for uniform strength throughout. It involves three main features:

Elliptical shaped heads.

Reinforcement of all openings and other discontinuities.

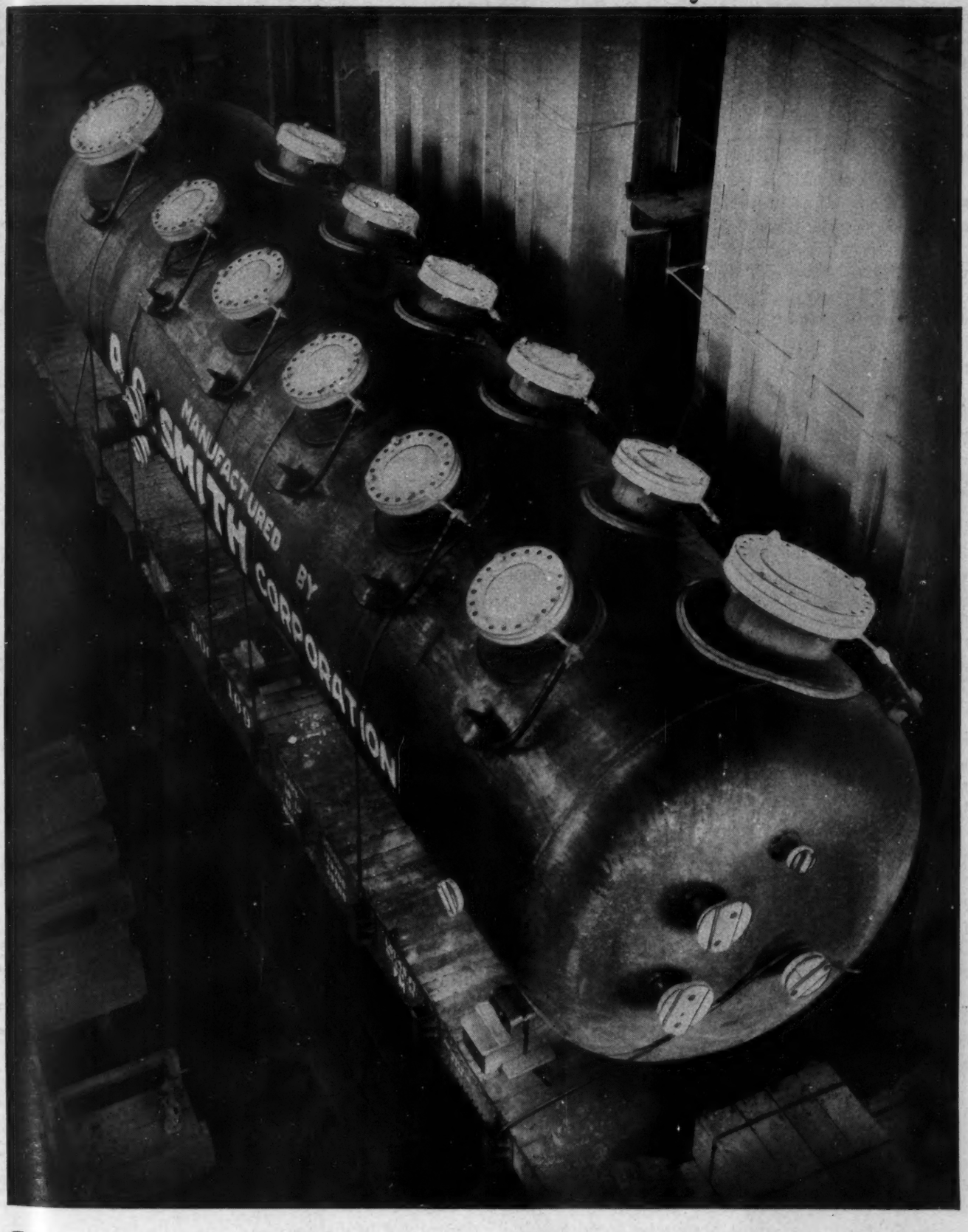
100% joints and seams.

The value of these important features, originally based on theory, has been proved repeatedly by tests to destruction of full-sized vessels.

A. O. SMITH CORPORATION

Oil & Gas Field Products Division

SMITHWELDED



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CRACKING STILLS

mixture, and heavy oil, even if it does not readily vaporize, can flow along the ground to take fire from a still or boiler furnace or welding torch. Therefore, all possible precautions must be taken to prevent leaks in the equipment, and fire-fighting materials must always be at hand and in good order to conquer a blaze that may occur if these fluids do break out of control.

The fire hazard arising from the fluid nature of oil, to some extent may be lessened by the use of dikes around tanks and adequate sewer and transfer systems.

It may seem a simple matter to determine the preventable hazards in a refinery but it is not. It requires constant vigilance to keep a plant safe. A searching investigation of most any operation by a "safety-minded" inspector will usually show up some dangers that had passed unheeded.

For instance, a gauge glass on a distillate tank might fail or a distillate pump might blow a gasket. Normally, these are not serious matters. The former mishap would release a small quantity of liquid and gas into the tank enclosure before the ball check safety valves could act.

Failure of the pump gasket would discharge some liquid and vapor into the atmosphere of the pump house.

However, accidents sometimes occur in a manner similar to the sequence of events in the well-known house that Jack built. That is, when the gauge glass broke an unguarded electric light bulb may have been burning nearby. The rupture might shatter this bulb, producing a spark which would ignite the vapor mixture, causing a serious fire.

In the other case, a telephone might have been located in the pump house. The man in charge might have lifted the receiver off the hook, when the pump gasket failed, to call a mechanic to make repairs. This action may have caused a spark, which set off the air vapor mixture.

These two things might not happen once in a life time, but they are typical of the unexpected hazards which may occur. The first one could and should be prevented by using only armored electric lamps and gauge glass guards about a cracking plant, and by placing all lamps where they would not be subject to such shocks as the breaking of a gauge glass.

In the other case, of course, such an accident could be forestalled by keeping telephones out of buildings where explosive mixtures of vapor and air could possibly be generated.

ETERNAL VIGILANCE REQUIRED

It is the elimination of such hazards as those just named that call for eternal vigilance, thorough knowledge of all phases of the cracking equipment and operation, and "safety mindedness."

The following facts must always be borne in mind when studying safety in cracking operations:

(a) In general, the liquid or vapor is heated to a high temperature, and this tends to increase the possibility of self-ignition when brought in contact with air.

(b) At the higher temperatures, sulfur compounds contained in the liquid or vapor are usually more destructive to container and conductor equipment that at lower temperatures. Some other corrosive compounds are more destructive when and after the vapors are condensed.

(c) Under the temperature prevailing in a cracking plant the strength of the equipment is materially reduced, making it less resistant to the pressure employed.

(d) The boiling range of cracking stock in process is in excess of that of water. That means that any water introduced accidentally into the system flashes into stream instantly, building up excessive pressure which may be very dangerous.

(e) When the pressure used is above atmospheric, the boiling points of the cracking stock are raised, the latent energy is increased and the risk of serious damage, should the equipment fail, becomes greater.

Recognition of these facts has brought improvement in design, quality of material, inspection and maintenance of cracking apparatus, which reduce the number of fires and accidents. Constant vigilance will reduce the hazard still more.

NECESSITY WIDELY RECOGNIZED

Refining companies have recognized the necessity for employing a high type of workmen if the utmost safety in cracking operation is to be realized. Not only should such men be employed for cracking duty, but they should be carefully schooled as well by competent instructors in every phase of the cracking operation.

In order to provide the maximum safety in any given cracking unit it is advisable to do the following things: (a) make a detailed inspection of each unit, from the raw oil tanks to the distillate run down tanks; (b) develop a flow chart in detail and familiarize every man in all crews with the complete working of the unit; and (c) analyze and establish definitely the best method of operation for a complete cycle; emergency shutdowns; various possible mis-operations.

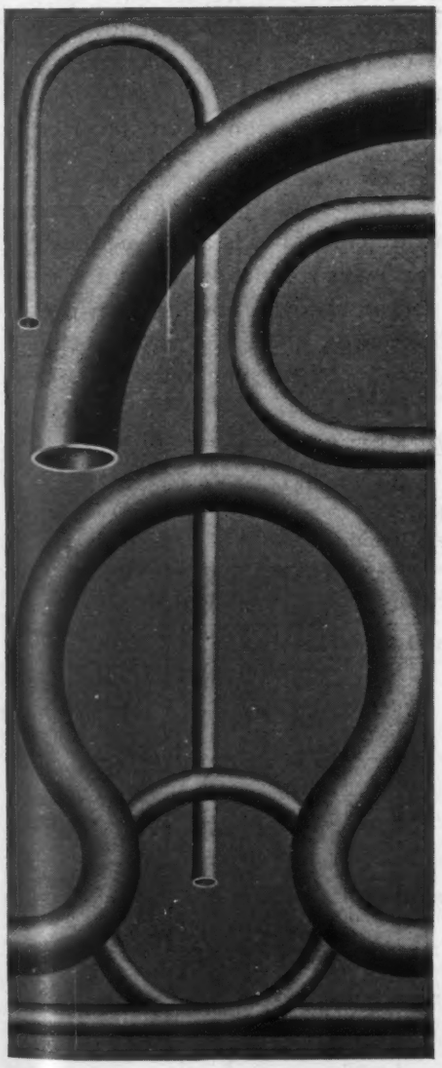
Analysis should also be made of the following: (a) personnel; (b) supervision maintained over the operations and equipment; (c) safety equipment; and (d) system of inspection of physical equipment.

Further, all potential hazards and unsafe practices should be determined and corrected.

The most serious hazards in cracking operations arise from water, vapor, corrosion and the human element.

These hazards and means for their elimination or control will be discussed in detail in the series of seven articles to follow.

THE RIGHT PIPE FOR BENDS



The best of installation practice will not impart to a piping system qualities necessary for long life and satisfactory service. Durability must be in the structure of the pipe itself. When a certain make of pipe is used so generally for refinery piping, particularly where bending is involved, you can be sure that refinery engineers have an extra measure of confidence in its ability to make good.

NATIONAL Pipe has won this greater confidence—through the years—by constantly and consistently proving its particular fitness for every kind of difficult bending job. Whether welded or seamless—its unusual uniformity, strength and ductility have proved it the right pipe.

If you want pipe that is easy to bend, economical to install and extra worthy for difficult service—specify NATIONAL—

America's Standard Wrought Pipe

NATIONAL TUBE COMPANY, Pittsburgh, Pa.
Subsidiary of United States Steel Corporation

NATIONAL PIPE

WELDED OR SEAMLESS

Budgets and Costs

By R. E. KERFOOT
Cost Accountant

THE operating executive of any successful enterprize, in this, the most highly competitive era we have ever known in the industrial world, makes for success because of the interpretation and the application of the data with which he is supplied. The information comes to him prepared in a condensed yet comprehensive form, at the proper periodical time to be of greatest importance, and permits the exercising of complete control so absolutely essential. The results of all departments, for the period under review, have been fully coordinated, and faithfully reflect that which has occurred.

Such a condition is, of course, the ideal one, and to which many concerns have attained, primarily, no doubt, because of the method of collecting, compiling and disseminating all information has been given much study and consideration in advance, the result naturally being highly satisfactory.

Complete success in any undertaking does not come of itself, but is greatly measured by the plans that are laid in advance, coupled with the value of experience gained from past operations and applied to the current need. Hard work is frequently considered a prime factor here, but we contend that perfect control of all features is the most essential of all, and may, or may not, be hard work, in accordance with the clarity of the data furnished for the use and guidance of the executives responsible for thorough efficiency in all respects.

It is not only the chief executive who is vitally interested in cost information, but also the minor executives or department managers, the labor foremen, and on down the line, each of them being responsible for some particular functioning in the general scheme, making up the whole. From the cost accountant's view, and insofar as his cost data presentations are concerned, an executive is one who guides, directs and controls the work of others, whatever his position may be in the long chain beginning with the chairman of the board.

Many of these men do their thinking and planning in terms other than those used commonly in accounting practice, and they should have their data come to them in the form of charts and graphs, or ratios, or in whatever method they are most accustomed to.

It is the desire, here, to bring attention to a few reports found to be of especial value to several refiners. Many of the readers are, we are sure, quite familiar with much of the information to follow, presented in a more or less composite manner, and gained from many sources. It is, generally, only basic, and may be elaborated upon to whatever extent desired.

In our opinion, the budget plan of operation, coupled with authentic cost data, is a real necessity, and we believe, that when functioning in its entirety, is difficult to be improved upon. If, however, it is operated indifferently, it may as well be eliminated, or not begun, for the prime purpose is in-

REVENUE AND EXPENSE SUMMARY

For the Month of_____1930
and
_____Month Period to Date.

	This Month		Period	
	Estimate	Actual	Estimate	Actual
REVENUE:				
Sales				
Tank car earnings				
Other (detail)				
TOTAL				
EXPENSE:				
Operating (form 2)				
Selling				
Administrative and general				
Other(including fixed charges)				
TOTAL				

BUDGET FORM No. 1

stantly destroyed. We do not contend it to be the only method of determining the desired results, but we do maintain, that it can be made to be of inestimable value.

REVENUE AND EXPENSE SUMMARY, FORM 1

This form of report is, as shown, a combination of estimated or budget figures, and those taken from the monthly financial operating report, the data being stated only in a summarized manner.

The figures under the column headed "Estimate, This Month", are prepared well in advance, by the departments having the responsibility of creating the revenue, or income. This may be segregated in accordance with the individual requirements of the company, or to whatever extent desired. It is found to be a very practicable plan, to compile tentative budget figures quarterly, which gives the opportunity of revising the "present month" figures, just before the beginning of that month, in the event of any unlooked for change in policies or conditions, not existing three months previously, or at the time the original estimate was prepared.

Having had the benefit of past month's experience before him, and giving consideration to seasonable demand, contracts, stability of market and other factors that may affect the upward or downward trend of the product to be marketed, the sales manager is in a good position to consistently prognosticate the amount of income. Constant supervision and contact with actual current affairs, lends much to the accomplishment of future endeavors.

As a comparison between that which was expected to be received as revenue, and the actual amount received, entry is made in the column headed "actual,"

OPERATING EXPENSES AND PRODUCTION COSTS

For the Month of_____1930
and
_____Month Period to date.

	This Month				Period			
	Estimate		Actual		Estimate		Actual	
DIRECT:								
Labor								
Chemicals								
Maintenance and repairs								
Royalties								
Other								
TOTAL DIRECT								
INDIRECT:								
Superintendence								
Office								
Power								
Fuel								
Laboratory								
Compensation insurance								
Auto and truck								
General plant repairs								
TOTAL INDIRECT								
TOTAL OPERATING EXPENSE								
CRUDE OIL USED								
TOTAL PRODUCTION COST								

BUDGET FORM No. 2

SALES AND PRODUCTION

Month of_____1930

In Barrels of 42 U.S. Gallons.

	Sales Department Requirements				Refining Department			
	Estimate		Actual		Estimated Production		Actual Production	
PRODUCT:								
Gasoline								
Naphtha								
Kerosene								
Gas oil								
Fuel oil								
Lube stock								
Loss								
TOTAL								

BUDGET FORM No. 3

INCREASING EFFICIENCY *of* Fourth Stage Chilling

Refiners using the York Ammonia Liquid Circulating System have increased the operating efficiency of fourth stage chilling of cold test oils. They are daily producing temperatures as low as minus 60° F.; they are maintaining constant pressure in chillers; they are effecting important economies.

The entire evaporating surface of the system is continually wetted by ammonia, making every square foot of evaporating surface active in cooling. Absence of static pressure in the ammonia liquid which enters the chillers at the top, increases operating suction pressure. Less gas need be compressed and hence much less horsepower is required per ton of refrigeration.

The York Ammonia Liquid System is unique in providing constant

temperature and pressure throughout the evaporating coil surface.

The York Ammonia Liquid Circulating System, in conjunction with the York Booster or Stage Compressor, can be added, as an integral unit, to your present refrigerating machinery...with resultant operating economies.

York engineers are at your service for consultation regarding this or any other of your refrigerating problems. Address the nearest of York's 71 direct factory branches. It is conveniently located to your business.

YORK ICE MACHINERY CORPORATION » YORK, PENNSYLVANIA

Advantages of the

YORK PATENTED AMMONIA CIRCULATING SYSTEM

Lower Operating Costs: **Higher operating suction pressures with attendant increase in operating efficiency and decrease in power consumption.**

Lower Temperatures: **Lower temperatures with minimum evaporating surface.**

Ease of Operation: **Evaporating system may be cut out of service by merely stopping the ammonia recirculating pump. It is unnecessary for the operator to adjust valves to regulate the flow of liquid ammonia through the evaporator.**

Safety: **Assures dry gas to the compressor, thereby eliminating compressor troubles and increasing the life of the equipment.**

Flexibility: **Its refrigerating effect is immediate. Entire charge of liquid ammonia is carried in the low pressure receiver, precooled to evaporating temperatures, available for instant use.**

Easily Defrosted: **Especially adapted to the low temperature work required in fourth stage chilling. The evaporating system may be drained of liquid ammonia and hot gas introduced to the coils. Defrosting is positive and rapid.**

YORK
REFRIGERATION

of the actual amounts invoiced or accrued. Having the items side by side, allows a quick examination of the differences, which may be easily analyzed.

The same principle applies to the expense section of this form. Provision is made for the further analysis of operating expenses, and is contained in Form 2. Likewise, any of the other items may be detailed and a separate schedule prepared, if the demand for this information warrants it.

The primary thought in the preparation of this form was to provide a method of exhibiting this particular information in a simple, yet concise manner, and at the same time allowing it to be sufficiently elastic or expansive to take care of future changes.

It may be further utilized by being plotted on a chart or graph, and will then present a pictorial comparison, frequently desired, but always of great assistance.

It will be noted also, that columns are arranged for accumulative figures, and in addition, arrangement could be made to take care of percentage calculations, as well.

OPERATING EXPENSES AND PRODUCTION COSTS FORM 2

In preparing Form 2, consideration must be given to many elements, if the data prepared pertains to a refinery. We must first consider a normal operating day—the number of employes required to be on duty for that purpose—determine in advance what percentage of capacity efficiency is to be maintained—quantity and value of chemicals to be used, according to the method of refining employed—what major repairs for changes are to be made—and other features of physical performance with which the superintendent is familiar. Having determined the amount of the more important direct expenses, the other items are not so difficult, as they are, to a large extent, dependent upon the former.

This report, when completed, will serve in many ways, as it will show just how well the superintendent is in touch with the actual conditions that exist, and just how close he is able to keep to the line he has previously drawn for himself, by reporting in advance, what he expects to accomplish.

From this information may also be found the cost per day (24 hours) of operation, and which can be used as a guide in arriving at future operations. The constituent factors are not so difficult to be found, for, after a plant is erected for a certain purpose and operated accordingly, past experience in daily operation reflects the need in labor and material.

At the close of each month, the refining department should be supplied with certain cost data figures. These may indicate, that per barrel of crude oil run, the fuel cost is excessive, and instantly arises the question of why. The alert superintendent will at once take steps to correct this situation and recommend such physical changes as would bring about an economy here. Complete economy may be had, but only after the point of entire efficiency has been found, and then by watchfulness, may be maintained.

It is just as important to the plant operator to know certain costs currently, as it is for him to know the actual yield received of finished products.

The budget comparison of expected and actual results, certainly acts as an incentive to do just a bit better, and soon the effect becomes apparent among all, and a pleasant rivalry exists between the different shifts. Simple comparative charts for the information of the men, fit in nicely, and more interest is displayed in the daily work to be done, the highest standard of efficiency maintained and not sacrificed.

SALES AND PRODUCTION—FORM 3

It is of course the natural desire of the sales department to market as much of the finished products as is possible and to move it at the best available price, and this department should be able to foretell, reasonably in advance, just what their requirements will be.

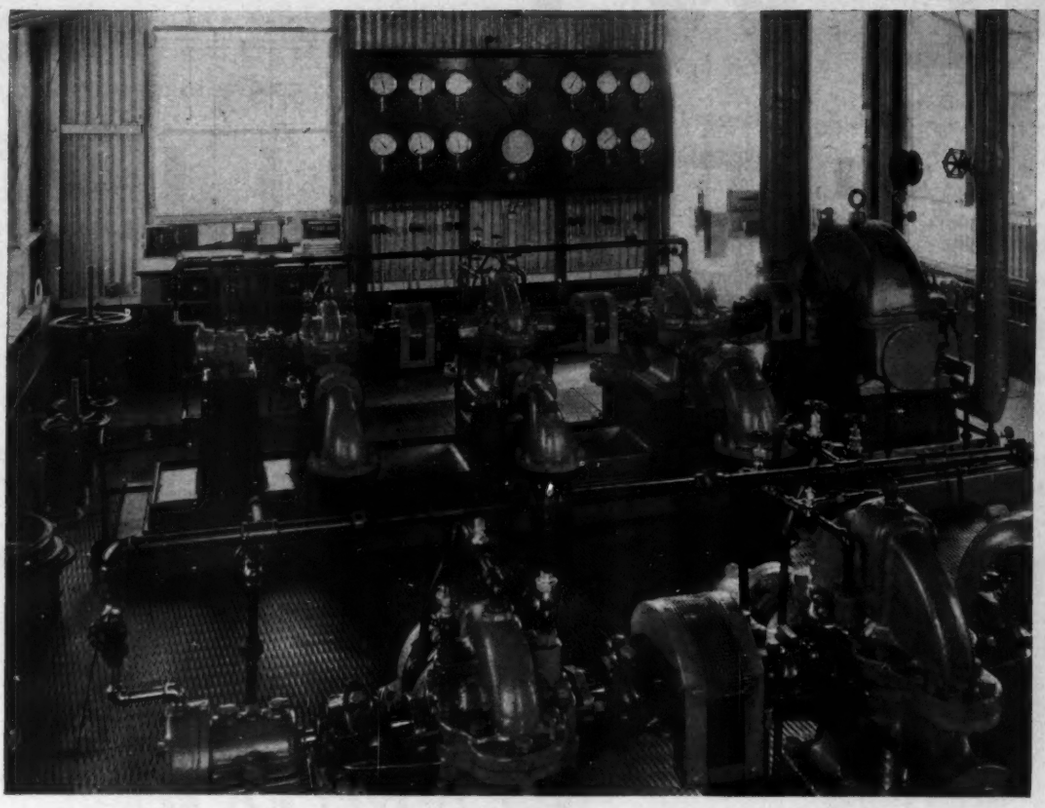
At the time the sales manager prepares his budget data of expected revenue to be included in Form 1, he must necessarily at the same time, determine the quantity he expects to deliver. In his own department he may make such segregation as to the source of the various products needed, as he wishes, but here, on Form 3, is shown only the total barrels required. At the end of the month, from the income section of the operating report, is inserted, under "actual," the total barrels of each product invoiced. This gives an easy comparison and creates quickly, the incentive to sell more than the quantity reported as "required".

The refining department section of this report is equally important, for knowing definitely the yield to be had, the daily capacity, and the normal percentage of efficiency obtained, they can anticipate the quantity of finished products they will produce.

If, after the estimated quantity of sales department requirements and refining department production has been determined, there exists a variance in the quantities, action is taken immediately to overcome a situation that may affect the revenue. If the sales department has expected requirements for the month of more than will be produced by the refining department, and considering, of course, fin-

(Continued on page 120)

TERRY



EFFICIENT TURBINE DRIVEN UNITS FOR THE GASOLINE PLANT

Illustrated above is a 133 HP Terry Turbine installed in a gasoline plant of a Western oil company.

The unit delivers 1800 gallons of water and 550 gallons of lean oil per minute.

A well balanced flow of oil and water is assured at all times. The unit is compact, efficient, flexible and occupies a small amount of floor space. Maintenance and packing problems are reduced to a minimum.

Full information on Terry turbines for pump drive or any other application furnished on request.

The TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.
Steam Turbines - Gears - Shaft Couplings

T-1068

NEW!

LEACH FRACTO CONDENSERS

of STANDARDIZED DESIGN

Three Types are available—

The Standard Vertical Fracto Condenser

The Inverted Type, and

The Tower Type for use on bubble towers

Leach designs are fully protected by patents in the United States and foreign countries

Fracto Control TRADE MARK REG.

LEACH

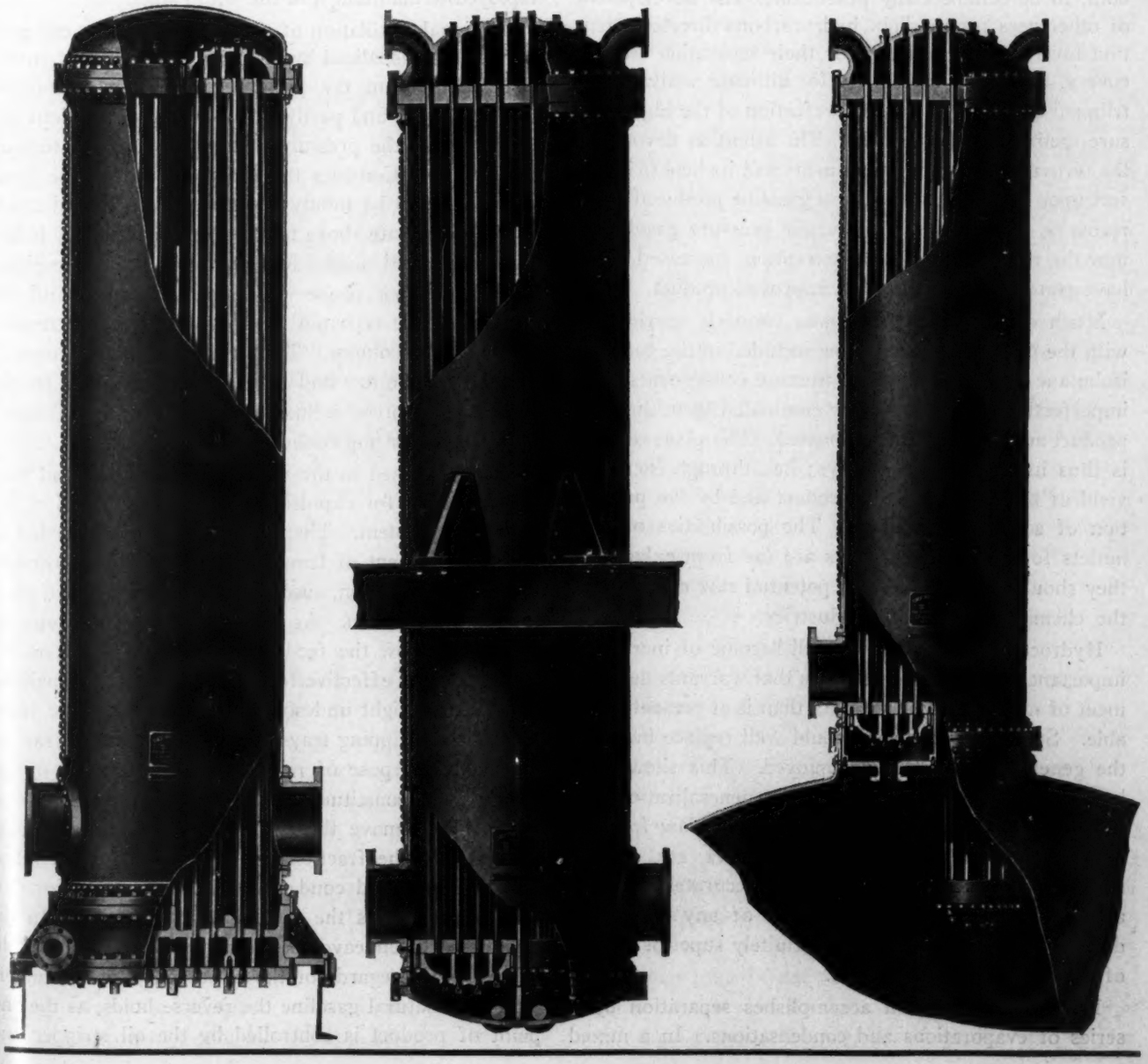
LEACH FRACTO CONDENSERS designed for quantity production are now available for low pressure service. These exchangers embody the Leach features used in the Leach High Pressure Exchanger for cracking coil service at 1500 lb. pressure and 800° F. but are of lighter weight for 125 lb. and 250 lb. pressure.

These Units possess the following Leach features:

1. Dividing floating heads to prevent loosening of tubes from temperature shock.
2. Multiple passes for high liquid velocities.
3. Progressive arrangement of passes so that hot and cold tubes are not adjacent.
4. Counter Current flow.
5. Separate bleeds from each vapor pass for fractional condensation.
6. Accessibility for Cleaning. Tube bundle can be removed or shell lifted for access to tubes.
7. Permanent Vapor Baffle. The vapor baffle is permanently fixed in the shell and slides between the floating heads when the shell is removed.
8. Condensate Collection Basins. Condensate is collected in cast basins. No joint or machined surface is submerged.
9. Vertical Shell and Tubes. Shell and tubes are not exposed to wear from condensate drip.
10. Large Tubes and Husky Construction.

C. H. LEACH CO.

9-11 Park Place New York



PART TWO

Rectification of Natural Gas Hydrocarbons

By I. N. BEALL

THE advent of high pressure fractionation marked for the natural gasoline industry a distinct step forward. Hitherto separations between those constituents too light for incorporation with the finished gasoline, were either too expensive, too complicated, or both, to be commercially practicable. The development of other uses for the light hydrocarbons directed attention towards better means for their separation and recovery. Laboratory apparatus for ultimate analysis contributed on small part to the perfection of the high pressure method of fractionation. The attention devoted to the recovery of lighter constituents had its beneficial effect upon the quality of natural gasoline produced: high recovery, high gravity, low vapor pressure gasoline is now the rule rather than the exception. Increased yields have gone hand in hand with improved product.

Much of the butane that was formerly carried out with the pop-off vapors is now included in the gasoline, isobutane and higher partial pressure constituents, once imperfectly separated are now eliminated from the main product and separately fractionated. The plant revenue is thus increased in two ways; i.e., through increased yield of better grade main product and by the production of saleable by-products. The possibilities of new outlets for light hydrocarbons are far from exhausted, they should be regarded as a potential raw material for the chemical engineering industries.

Hydrocarbon fractionation will become of increasing importance and the subject is one that warrants development of more fundamental data than is at present available. Specific information could well replace much of the generalized data now employed. This should not be construed to mean that such generalizations as Raoult's law for liquid solutions, Dalton's law for partial pressures, Boyles and Charles' laws, etc., should not be used because they do not accurately express actual conditions. The application of any justifiably derived physical hypothesis is infinitely superior to rule of thumb or pure guess work.

Fractional distillation accomplishes separation by a series of evaporations and condensations. In a mixed system such as the feed to a natural gasoline distillation unit there exists material which retains the liquid state only because of high pressure and/or admixture with heavier less volatile constituents. If this lighter material is separated from the mixture, higher pressures must be employed to maintain it in the liquid state.

Fractional distillation of the continuous type can perhaps best be visualized by picturing the feed as it enters the column from the preheater. This feed consists partly of liquid and partly of vapor, the proportions depending upon the pressure, temperature, and nature of the mixture. Consider these vapors which arise from the mixture to be totally condensed then heated again for the next plate above to a temperature slightly below that of the feed plate. Re-evaporation will take place, liquid and vapor phase will again be formed and the process will be repeated on up through the successive plates of the column. The actual working column is heated at the bottom and cooled at the top, and a partial condenser or forced reflux of overhead condensed liquid is used to effect top cooling.

Energy is used in the work of evaporation and condensation and for expulsion of vapors overhead to the condensing system. Therefore a re-boiler is needed to keep the gradient of temperature, which is essential to fractional separation, successively higher for each plate from top to bottom. As the reflux ratio is heavier on the plates below the feed, this makes the work on the stripping more effective for the separation of remaining traces of the light undesirable constituents. The function of the stripping trays and re-boiler may be said to be for the purpose of removing the last traces of the more volatile constituents while that of the fractionating trays is to remove the remnants of less volatile constituent. In the fractionation for motor fuel in refineries the overhead condensate is the product; for natural gasoline it is the underflow or bottoms. In the first case, the endeavor is to cut out the end point without excessive regard for the initial point of the underflow; for natural gasoline the reverse holds, as the end point of product is controlled by the oil stripper and

subsequent knock-outs which leaves the control of the initial boiling point for the final column. Natural gasoline may then be said to be the intermediate cut between two fractionating columns.

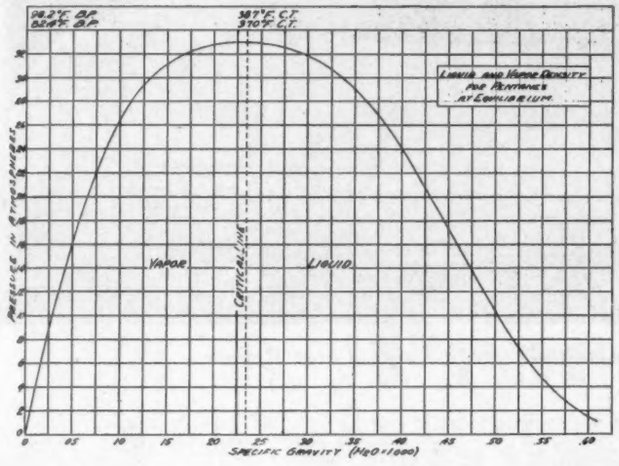


Chart No. 1

EASILY REFLUXED

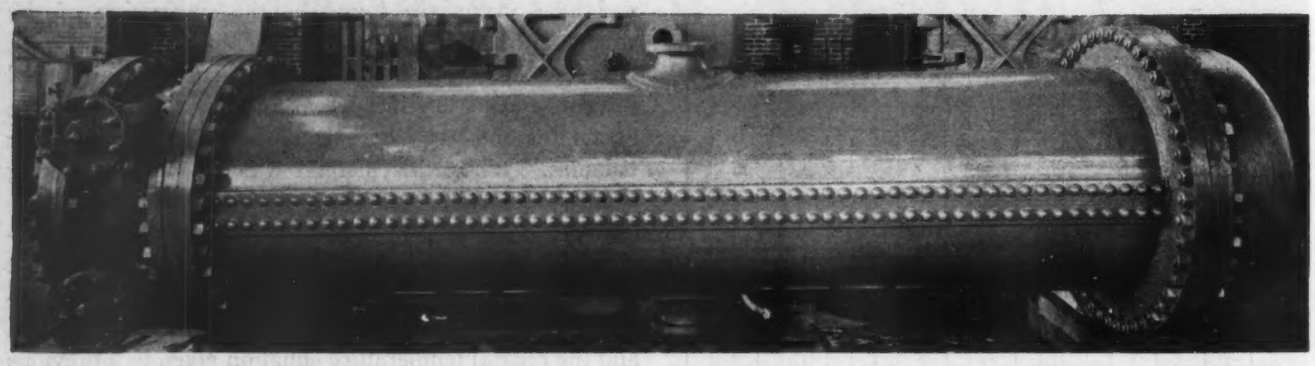
For motor fuel fractionation there is no difficulty in refluxing the finished (overhead) product back to the column, as total condensation takes place at ordinary temperature and pressure. However, there is difficulty in the return of overhead vapor condensate from a natural gasoline column because of its highly volatile nature. Where only partial condensation takes place it is of importance to have an idea of what the liquid and vapor phases consist and their relative proportions. There is a formula and method by which this may be determined assuming an analysis is available of the overhead vapors before condensation. This formula is given by Murray (J. I. E. C., Oct. 1929, pp. 917-919) as $\frac{A_1}{L} = \frac{A}{100\frac{P_a}{P} + L\left(1 - \frac{P_a}{P}\right)}$ in the approximate form and as $\frac{A_1}{L} = \frac{}{L\ 100\left(\frac{P_a}{P}K\right) + \left[1 - \left(\frac{P_a}{P}K\right)\right]}$ in the exact form where A equals the mol per cent of a pure constituent in the mixture, A_1 equals pound mols of the component in the liquid, L equals pound mols of liquid, P_a equals vapor pressure in the pure state at the temperature of operation, and P equals operating pressure, K is a correction factor for Raoult's law. If on substitution in the equation A_1 is greater than unity, $\frac{}{L}$ liquefication will take place. Equations are formed for each constituent present in the same manner described, the components are designated as A, B, C, D, etc., proceeding in each case as before. The values for L are determined by trial substitution from inspection, interpolating between the high and low values. Total gas and total vapor are found by the summation of the values A_1, B_1, etc. $A - A_1$; $B - B_1$, etc., giving A_g, B_g, etc., for uncondensed vapor. All calculations are based for convenience on 100-pound-mols, multiplying by the actual factor at end of calculations to convert to true volumes. While this method was given for checking compressor action, it is also useful for calculations pertaining to fractionator operation for natural gas hydrocarbons. A double check can be had on whether or not a vapor system will condense at all under pressure without lowering the temperature, by use of this equation and the critical temperature equation given in a previous article. (REFINER AND NATURAL GASOLINE MANUFACTURER, December, 1930, Page 67). All such empirical calculations are of assistance in determining correct column operating pressures and temperatures.

In Chart No. 1 there is plotted the experimentally determined vapor and liquid densities of pentanes at equilibrium pressures. Both vapor and liquid densities are plotted against water equal one so as to be comparable. It will be noted that at the critical point liquid and vapor densities are identical. Such charts as these are important to the calculations for liquid and vapor flow. Thus, for example, at 16 atmospheres the liquid density is 0.46 and the equilibrium vapor density is .05. The weight of one cubic foot of vapor in pounds equals $62.3 \times .05$ equals 3.115 pounds. The molecular weight of pentane is 72.10, therefore the equilibrium vapor of one mol-pound of pentane at 16 atmospheres occupies $72.10 \div 3.115 = 23.11$ cu. ft. For the liquid $62.3 \times 0.46 = 28.658$ lbs. cu. ft. or $72.10 \div 28.658 = 2.52$ cu. ft. The design of fractionating columns is dependent upon a knowledge of the relationships between liquid and vapor volume. More experimental data is needed along the above lines for the lighter hydrocarbons and hydrocarbon mixtures. Thus, whereas the pound-mol volume of pentane at the critical temperatures and pressures as calculated by Boyles and Charles' law would be 26.3 cubic feet, the actual volume is 4.93 cubic feet, as computed from the critical density. The divergence is so great as to appear ridiculous. The perfect gas laws cannot be said to apply to equilibrium vapors and such assumptions for purposes of calculations involving fractionator design are unjustifiable and lead to serious errors.

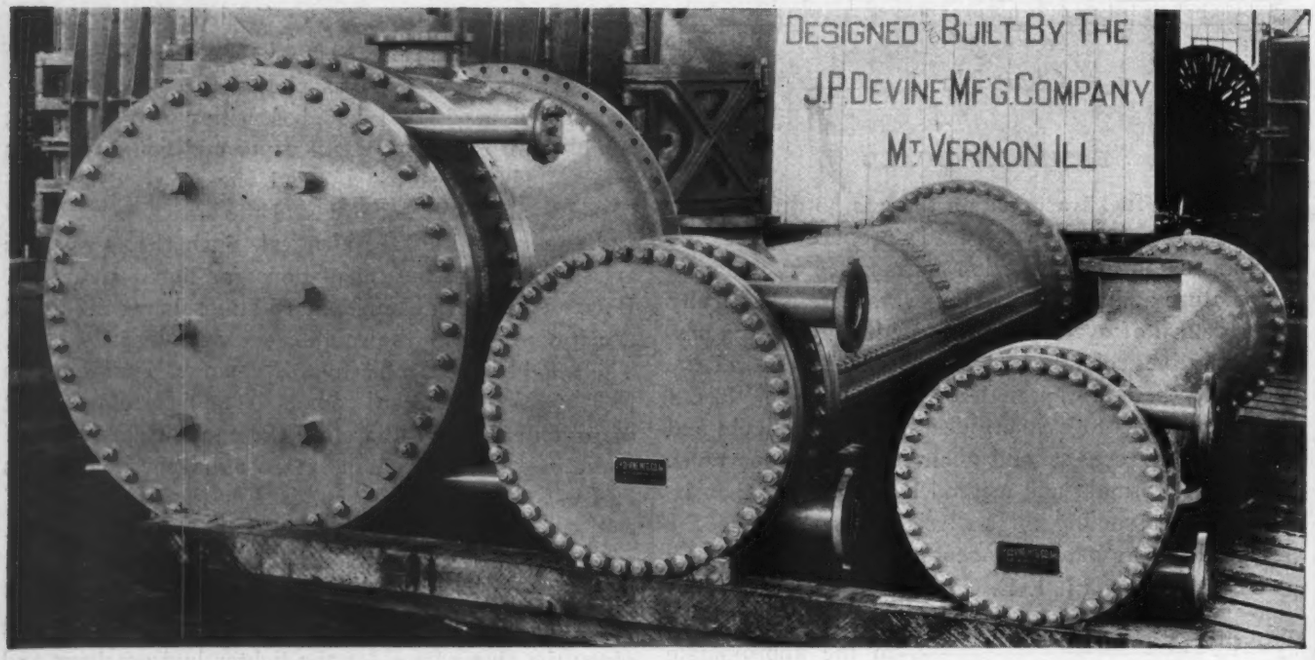
ORDER OF CHANGE

The intelligent selection of the rectifier is dependent upon a knowledge of the nature and flow of the mixture which is to constitute the feed. The problems which confront the engineer when requested for recommendations relative to column design and installation are rather formidable; first of all, a plant diagnosis is

We Are Fabricating And



34" x 12' Pressure Distillate Vapor Condenser Built for a Large Texas Refiner



Another Texas Installation: 54" dia. Vacuum Condenser, 300 square feet; 30" dia. Pressure Distillate Cooler; 20" dia. Pressure Distillate to Gasoline Vapor Heat Exchanger.

Rectifying Column, 4' x 60', Built for an Ohio Refinery

Sales Representatives For the Pratt Vapor Phase Cracking Process Equipment

IN the announcement on the preceding page the Automotive Distillate Corporation presents a new and sensationally successful cracking process for the production of a natural Anti-Knock blending fluid.

As sales agents of the leased rights and fabricators of the equipment the J. P. Devine Manufacturing Company offers unusual plant facilities which are reflected in low costs and speedy completion of all contracts. Your commissions are executed "From Blue Print to Shipment Under One Roof." We will be glad to have our engineers present the details of the Pratt Vapor Phase Cracking Process and show you, too, some remarkable plant economies which are reflected in the equipment costs. The J. P. Devine Manufacturing Company specializes in the heaviest plate work.

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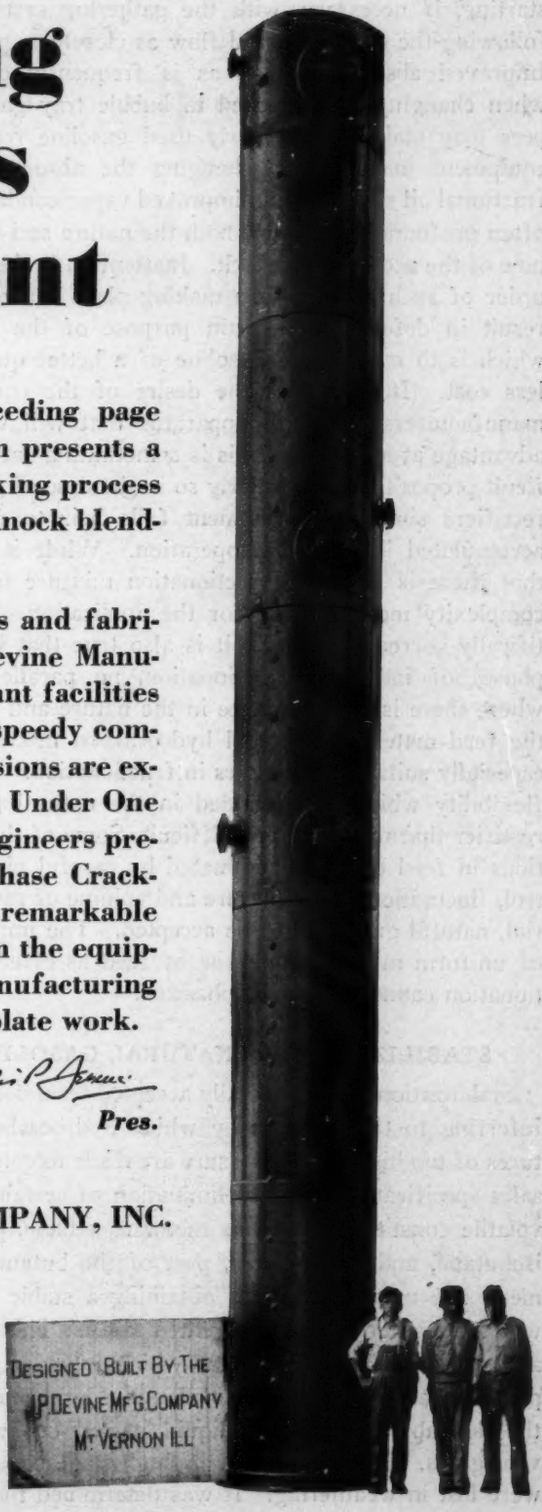

advisable with an eye to the future complications that may arise.

The fractionating system should be somewhat in keeping with the rest of the plant. In the piece-meal rehabilitation of old plants the installation of the natural gasoline rectifier should await other major changes, such as absorbers, strippers, heat exchange, cooling, condensation, accumulation, and control. Changes are always expensive and if not made in logical order the benefit derived may be nullified. For the modernization of an old plant, changes should follow the flow sheet, starting, if necessary, with the gathering system and following the gas and liquid flow as closely as possible. Improved absorption such as is frequently obtained when changing from packed to bubble tray gas strippers may make the formerly used gasoline rectifying equipment inadequate. Changing the absorption oil, fractional oil stripping and improved vapor condensation often profoundly influence both the nature and the volume of the accumulator stock. Inattention to the logical order of such details when making plant changes may result in defeating the main purpose of the change, which is to make more gasoline of a better quality at less cost. It is always the desire of the equipment manufacturers to install apparatus that will work to advantage at all times. This is sometimes a rather difficult proposition, particularly so in the case of gasoline rectifiers since this equipment falls heir to most of accumulated ills of plant operation. While it is true that there is no other fractionation mixture of equal complexity more suitable for the application of scientifically correct principles, it is also true that in other phases of industrial fractionation, no parallel exists where there is such variance in the nature and flow of the feed material. Natural hydrocarbon mixtures are especially suitable for studies in fractionation. It is the flexibility which is demanded in the natural gasoline rectifier that makes design difficult. Some of the variations in feed could be eliminated by careful plant control, fluctuations in the nature and volume of raw material, natural gas, have to be accepted. The importance of uniform mixture and flow of feed as effects fractionation cannot be overemphasized.

STABILIZATION OF NATURAL GASOLINE

Stabilization is the generally accepted term used when referring to that process by which hydrocarbon mixtures of too high vapor pressure are made to conform to sales specifications by the elimination of certain highly volatile constituents such as methane, ethane, propane, isobutane, and in instances, part of the butane. Formerly the only method for obtaining a stable product was to weather in open or vented tanks. This method accomplished the purpose for which intended but the process was extremely wasteful, for a large portion of the desirable less volatile liquid passed out with the vent gases. The gains made by high stage compression were lost in weathering. It was determined that better final yields could frequently be obtained by using a lower stage of compression. The significance of partial pressures as affecting vaporization in liquid mixtures was either not realized or else neglected.

The principles of fractionation were already highly developed when the natural gasoline industry was in its infancy, the natural laws upon which the designs of the present advanced types of columns are based upon far antedated the first compression plant. The industry as a whole has just recently awakened to the fact that increased yields and improved product result from the practical application of the generalizations of physics and chemistry. At the present time development is well abreast of theory but more fundamental data could be used to advantage. More accurate information is needed for the perfection and derivation of thermodynamic formulas. General laws are used where specific data is lacking. For example, certain of the fundamental laws governing the behavior of gases on compression depend upon the ratio of specific heats at constant volume and at constant pressure and experimentally determined data of this nature is missing for most of the hydrocarbons. Practically no information is available regarding the time factor in its relation to vaporization of liquid mixtures, yet the rate of vaporization would be of great importance to calculations involving problems of fractionation and absorption. But this is getting somewhat afield of the subject under discussion. It is very probable that the fundamental data will have already been available some time before that which is now available is fully understood and generally applied.

Following the practices of weathering in open tanks, packed and baffled columns were used for stabilization. This was another step forward. Had re-boilers and reflux condensers been used with a correctly designed packed column and sufficient operating pressure maintained, results closely approaching those of low pressure bubble type columns might easily have been obtained. The worst feature of all packed columns is the tendency to channel, causing lack of contact between ascending vapor and descending reflux. The same calculations are applicable to packed columns as are applicable to bubble tray columns if equivalents in vertical distance are considered. The packed and baffled type columns had their advantages for natural gasoline stabilization, however, and development was not complete at the time their use was discontinued by the industry.

LOW TEMPERATURE

The low-pressure low temperature stabilizer supplanted the packed column and may be said to have been the first widespread application of scientific design to natural gasoline rectification. The amazing growth of the industry is in no small part due to standardization of its products through widespread adoption of this method of stabilization. Theoretically the principle of separation is correct; ultimate gas analysis employs low temperatures when effecting close separations between constituents for purposes of analysis. Practically, on an industrial scale, the low-temperature low-pressure

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column had its disadvantages as had its predecessors. Cooling by the use of high stage compression product had its drawbacks although it was possible by skillful manipulation to partially overcome these difficulties. Where two stages of compression were used one procedure was to run the low stage accumulator product to the kettle and the high stage accumulator product to a tray at or near the top of the column. Inasmuch as the high stage product was of an ever changing nature, low temperatures would prevail over a period to be followed by higher temperatures. The consequence of these variations was carry-over with the pop-off vapors, imperfect separation of high partial pressure undesirables, and at times efficient separation which was difficult to long maintain.

Considering the characteristics and prevalent methods of plant operation, the low-temperature, low-pressure stabilizer gave excellent service. These columns possessed a rugged flexibility that well fitted them for use in the average plant. One of the prime essentials of close separation is lacking in these type columns—that is the control of reflux. Close fractionation demands that the liquid on the top trays closely correspond in composition to the type of material desired to separate as overhead to the condenser. This would be propane and isobutane when present. Ethane and methane need occasion no worry, for if there is separation between isobutane and butane, lighter hydrocarbons will of necessity be eliminated from the product.

The high pressure fractionating column for natural gasoline has largely replaced the low-temperature columns. One great advantage is in the ease of control of both pressure and temperature. The higher pressures permit condensation of overhead vapors by use of condensers cooled with plant water. This makes possible the use of forced reflux in the amount necessary for temperature control. Liquid on the top plates is then made to conform to what is demanded by equilibrium for separation. If propane and more volatile liquid is retained to the top tray, the split from the column will be between propane and isobutane if otherwise correctly operated. Reflux should consist essentially of the type of material desired to separate. This has already been discussed under fractionation of absorption oil. (REFINER AND NATURAL GASOLINE MANUFACTURER, July, 1930, Page 88). The same principles apply here. Where the feed contains an excess of butane over that required in the stabilized gasoline, the split is best made between butane and isobutanes. In such event only a portion of the butane may be returned for purposes of Reflux. Too much reflux may cause the tower to carry over liquid. Whenever liquid spray is carried overhead fractionation is poor.

NORMAL BOILING POINTS OF NATURAL GAS HYDROCARBONS

For ease of separation it is best to make the split between individual hydrocarbons rather than to attempt a cut solely on vapor pressure of product. A high gravity recovery gasoline indicates good fractionation. Natural gasoline should contain all of the pentanes and heavier, and as much butane as the specifications will allow. Drip gasoline will increase the product capacity for butane sometimes as much as one gallon for every gallon drip added. This is because of a lowering of the average boiling point of the product.

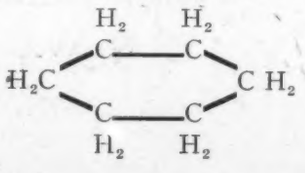
The normal boiling points of the hydrocarbons at atmospheric pressure is an indication of their relative volaties. See Table No. 1.

The table below shows that the temperature difference between consecutive boiling points is greatest for the lighter hydrocarbons. With increasing pressure, ΔT becomes larger, but the relative volatility decreases. Therefore more plates are required for a given separation at higher pressures, but less sensitive temperature control.

SEPARATION OF ISOMERS

Interest at present in so far as the natural gas hydrocarbons are concerned centers around the two butanes and three pentanes. Isobutane has the same molecular weight as butane, the differences in chemical and physical properties are due to the manner in which the hydro-

TABLE No. 1

Name	Formula	B. P. °F	ΔT °F
Methane	CH_4	—263.2	...
Ethane	CH_3, CH_3	— 35.	28.
Propane	CH_3, CH_2, CH_3	— 49.0	70.4
Isobutane	$(CH_3)_3 CH$	+ 13.1	62.1
Butane	CH_3, CH_2, CH_2, CH_3	31.8	18.7
Neopentane	$(CH_3)_4 C$	49.1	17.3
Isopentane	$(CH_3)_2 CH, CH_2, CH_3$	82.4	33.3
Normal Pentane	$CH_3, CH_2, CH_2, CH_2, CH_3$	97.2	14.8
2.2 Dimethyl Butane	$(CH_3)_2 CH, CH_2, CH_2, CH_3$	121.3	24.1
2.3 Dimethyl Butane	$CH_3, CH (CH_3)_2 CH, CH_3$	136.6	15.3
2 Methyl Pentane	$CH_3, CH, CH_3, CH_2, CH_2, CH_3$	143.6	7.0
3 Methyl Pentane	$CH_3, CH_2, CH, CH_3, CH_2, CH_3$	147.2	7.0
Normal Hexane	$CH_3, CH_2, CH_2, CH_2, CH_2, CH_3$	176.2	3.6
Cyclohexane		176.2	11.0

TWO CROSS CRACKING STILLS which are part of a battery of ten constructed by Kellogg for a large eastern plant. The experience of this refiner, who has returned to Kellogg year after year for additional equipment, demonstrates the value of Kellogg units.

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gen and carbon atoms are grouped. The two structural formulas are, butane, CH_3, CH_2, CH_2, CH_3 and iso-

$$\begin{array}{l} \quad CH_3 \\ \quad | \\ CH_3 - C - H \\ \quad | \\ \quad CH_3 \end{array}$$

butane. For the pentanes the structural formula are normal pentane CH_3, CH_2, CH_2, CH_2, CH_3,

$$\begin{array}{l} \quad CH_3\ H \\ \quad |\quad\ | \\ CH_3 - C - C - CH_3 \\ \quad |\quad\ | \\ \quad H\ \ H \end{array}$$

isopentane, neopentane

$$\begin{array}{l} \quad CH_3 \\ \quad | \\ CH_3 - C - CH_3 \\ \quad | \\ \quad CH_3 \end{array}$$

Isobutane, because of its high calorific value per gallon and its undesirability in natural gasoline, is especially attractive as a liquefied gas. Together with excess butane it is now largely used for this purpose, also as a carburent for artificial gas. The butanes similarly to the pentanes are chlorinated and hydrolysed to the corresponding isobutyl and butyl alcohols. The butanes are also suitable as refrigerants. The pentanes at present are used mainly for the manufacture of Alcohols. The amyl alcohols from the pentanes find wide use in the solvent industry and as a basic raw material in the manufacture of synthetic organic chemicals. For the manufacture of chemicals at times it is desirable to effect a separation between the isomers. It will be noted in Table No. 1 that the boiling points of the isomers of butane and pentane lie close together. From the standpoint of fractional distillation this would tend to make separation difficult. Fortunately, however, the organic stereoisomers obey Raoult's law quantitatively, therefore calculations for fractionator design and operation can be made with considerable confidence as to their accuracy. Propane, the next hydrocarbon in the series below isobutane is separated by a wide gap in boiling point, there should be no difficulty in effecting its separation by pressure fractionation. Should neopentane be present in the feed there would have to be more care exercised in the design and operation of a column to effect separation from the butanes than would

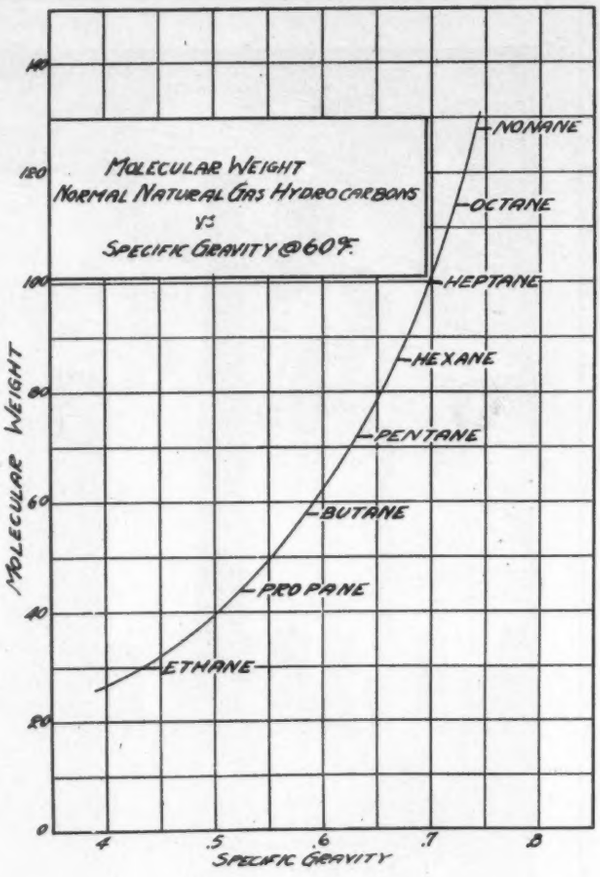
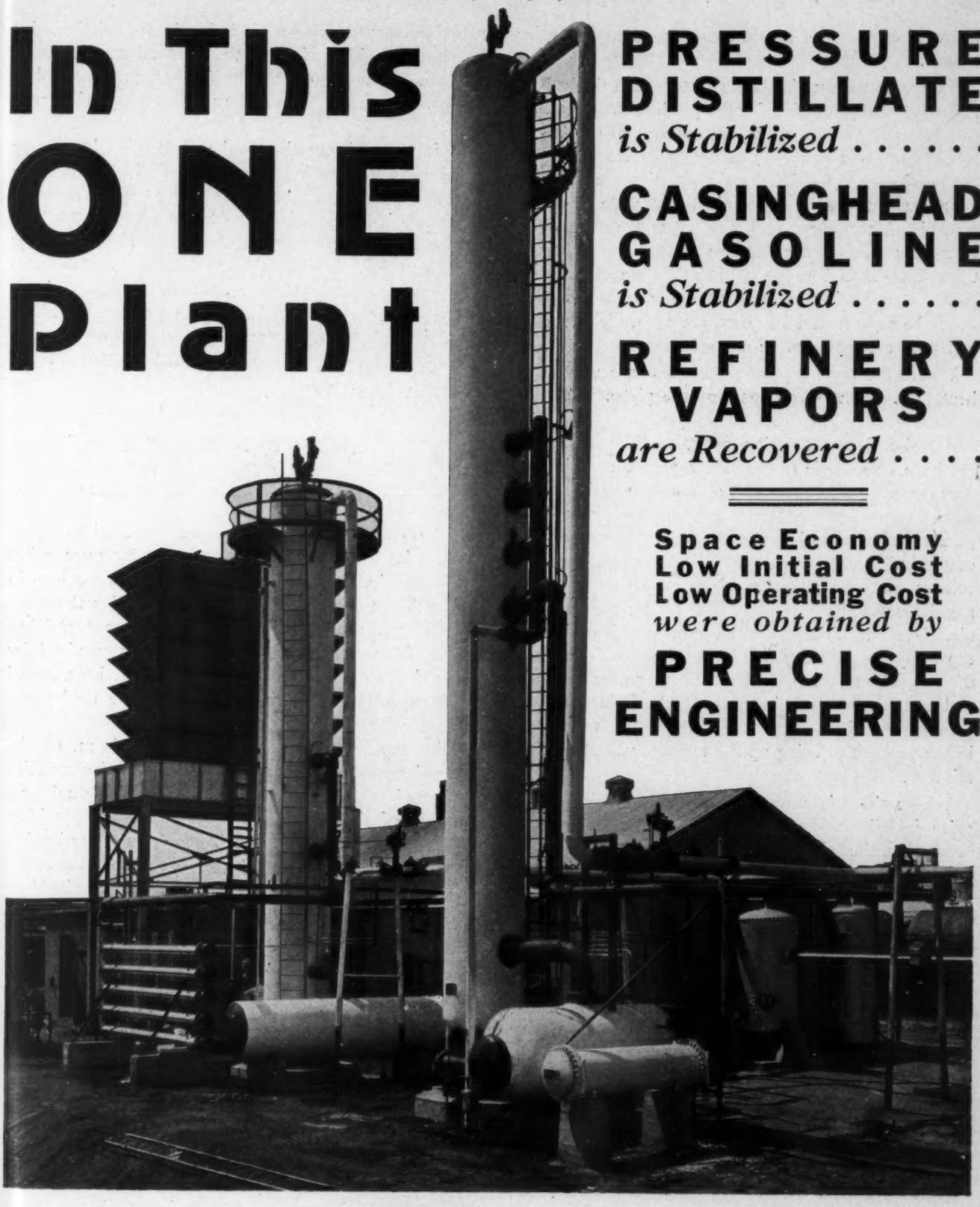


Chart No. 2

TABLE NO. 2
PHYSICAL PROPERTIES OF SOME NATURAL GAS HYDROCARBONS

Formula	Methane CH_4	Ethane C_2H_6	Propane C_3H_8	Isobutane C_4H_{10}	Butane C_4H_{10}	Isopentane C_5H_{12}	Pentane C_5H_{12}	Hexane C_6H_{14}
Molecular Wt.	16.03	30.05	44.06	58.08	58.08	72.10	72.10	86.11
State at S.T.P.	Gas	Gas	Gas	Gas	Gas	Liquid	Liquid	Liquid
B.P. °F.	—263.2	—135.4	—49.0	13.1	31.8	82.4	97.2	156.2
M.P. °F.	—299.2	—277.6	—310.0	...	—211.0	...	203.4	—137.7
(Air) S.G. Gas @ 60°F...	0.5546	1.040	1.525	2.009	2.009	2.494	2.494	2.979
(Water) S.G. Liq. @ 60°F	0.441	0.446	0.536	0.603@ 32°F.	0.586	0.628	0.626	0.662
Cu. '/lb. 60°F./760mm....	23.60	12.59	8.58	...	6.515	...	5.248	4.394
Lbs./Gal. @ 60°F.	3.678	3.720	4.470	...	4.884@ 60°F.	...	5.214	5.519
				...	4.998	...	13.83	15.60
Gallons per Mol	4.36	8.08	9.86	...	32°F.			
Vol. Gas/Vol. Liq.	640	345	283	...	10.62	...	202	180
Latent Heat B.t.u./lb.	....	228.4	184.0	...	263	...	154.4	142.9

In This ONE Plant



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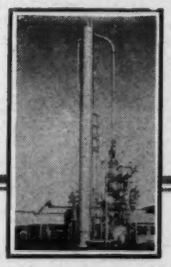

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be required for the separation of propane from isobutane.

The pentanes can also be separated from the hexanes and fractionally distilled for the production of the pure compounds. When separating mixtures of organic isomers the boiling points of which lie close together, the requirements for fractional separation are that there be a small temperature gradient per plate and close control of temperature, pressure, and reflux. The temperature difference between the top and bottom of the column should be less than the difference in boiling points at operating pressure of the components which are to be separated. This means a well insulated column and accurate temperature control.

Where the boiling point differences are very small, heating coils placed on some of the plates in sections will assist in keeping the plate temperature gradient low and make close separation possible. No attempts as yet have been made toward the separation of the hexanes on a commercial scale, although such is possible should conditions warrant. The extremely small temperature difference between the boiling points of some of the individual members would necessitate very close column control. However, there is no immediate demand for pure hexanes other than for purposes of technical interest. Separation of the butanes is of interest, especially for those plants engaged in the production of aviation gasoline. Debutanized natural gasoline makes an excellent light motor fuel. Where the isopentanes are absent a portion of the butane may be left in the product to bring up the average volatility of the mixture.

Where there is a market for the pentanes and the price justifies additional cost of equipment for their separation, there is scarcely any loss in the total volume of natural gasoline produced, as additional butane can be included to maintain the allowable average volatility. Where the proportion of pentanes removed from the product is small and butane is added to make up for their loss, the effect is not markedly noticeable on the specific gravity or the distillation curve.

EACH PLANT A PROBLEM

It would be difficult to find any two plants yielding the same type of natural gasoline feed stock. It is one thing to manufacture a product conforming to sales specifications but to be certain that all the hydrocarbon that can be included, have been included, is an entirely different matter. High gravity, high recovery, low vapor pressure and the percentage distilling below 100°F., affords the best practical means of judging whether or not fractionation is up to standard. Poorly fractionated gasoline is characterized by high vapor pressure, low gravity, low 100°F. recovery and high end point. A well designed fractionating tower is in reality a large size analytical apparatus. A more precise analysis is possible with larger size equipment because of the greater ease of temperature and pressure control. After a preliminary ultimate analysis has been made in order to obtain an idea of what the feed mixture consists, there is no need of making further analyses unless changes in operation cause the product to go off standard.

It is a mistake to change the plant procedure every time a gas analysis is made. Radical changes necessitate manipulation of the fractionating column controls, otherwise it is best to set the temperature, reflux and pressure and let the operation take care of itself during good behavior. In general, for the manufacture of natural gasoline, the higher the pressure of the accumulators the higher will be the column pressure required. To determine the optimum fractionating procedure requires an intensive study of individual plant conditions.

BUDGETS AND COSTS

(*Continued from page* 106)

ished oil in storage, the sales manager must see to it that he fulfills his committments, by purchasing such additional quantity as is needed, at no loss in price. Then, too, the burden is again with the sales department when the refining department finishes more of some particular product than is required for sales department disposition. It cannot be allowed to accumulate in storage, and must be sold, even though without a profit.

The comparisons exhibited on this form, of the sales department requirements and actual quantities delivered, as well as the expected and actual production of the refining department, is of considerable value to each, in that it creates the realization of the existence of a situation that must be coped with quickly, and one that cannot be permitted to go along unheeded. If it is unheeded, the results are usually unpleasant, and the same time, unnecessary.

The first section of a contemplated Manual on Disposal of Refinery Wastes has been published in the first, or 1930, edition by the American Petroleum Institute. The manual was prepared by the Committee on Disposal of Refinery Wastes, of the Institute's Division of Refining, under the chairmanship of A. S. Russell, in collaboration with similar committees of the Division of Production and Marketing. The first section concerns the disposal of waste water containing oil. It covers sources of oil in waste water; methods and devices for handling waste water and removing oil; recommended good practice for handling waste water and removing oil; recommended equipment and facilities; recommended operation and maintenance; and four appendices covering pollution of surface waters by oil, waste water separators, waste emulsions and sampling and testing waste water for oil.

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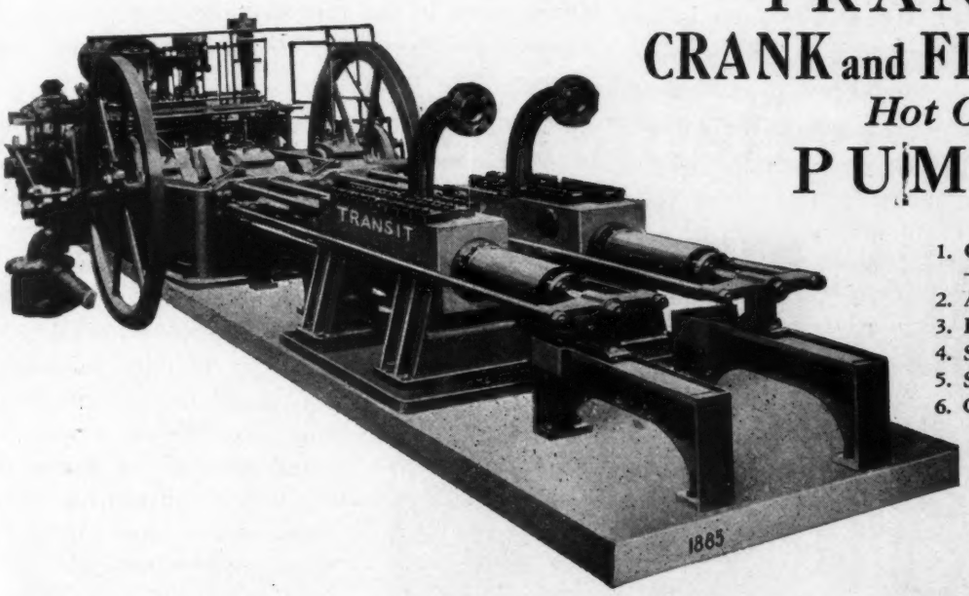

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Turbine Pump for Unloading Oil Cargoes

A FEW years ago the City of Portland, Oregon, Commission of Public Docks, purchased a No. 2 Byron Jackson two-stage vertical turbine pump for unloading oils from freighters at Portland docks. Since its installation this machine, now known as an "oil unloading pump," has been in continuous operation without any trouble or repairs, according to a report from the engineer for the Commission of Public Docks.

The pump is equipped with a make-up piece between the suction stage and a combined foot valve and strainer. The make-up piece is tapped for two 2½-inch hose lines. These outlets are equipped with two strings of suction hose, which are used for cleaning up purposes.

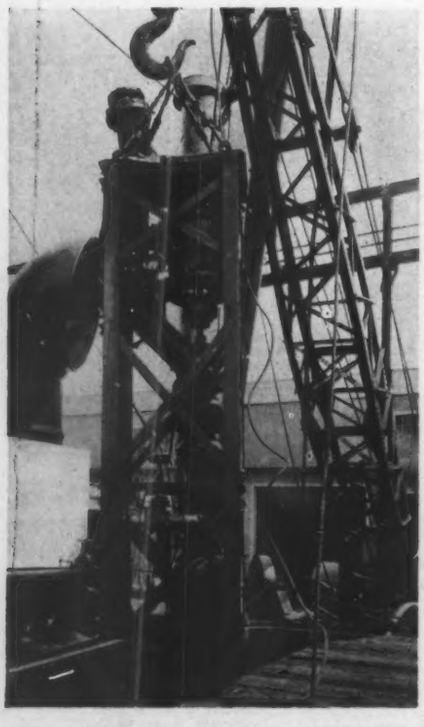
The pump is lowered into the hold of the ship and follows the oil down in the process of pumping. This is continued until the pump rests on the bottom and is then operated until it breaks suction, which happens when the oil level is within three or four inches of bottom. As soon as the pump breaks suction it is raised, the suction hose is attached and the process of pumping out the remaining few inches of oil is accomplished by means of suction nozzles. The suction mouth on the end of each hose consists of a 2-inch piece of pipe which is flattened out and resembles the mouth of a vacuum sweeper nozzle. In this way, practically all of the oil is cleared out.

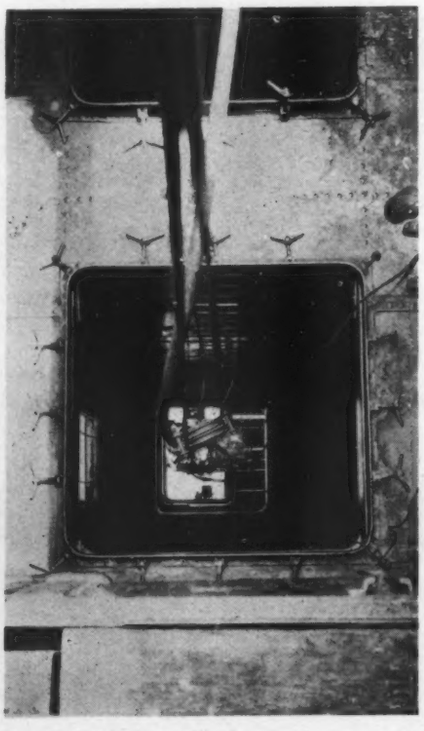
Construction of the pump very much resembles the Byron Jackson sinker pump, used by contractors in construction work for dewatering foundation excavations. The discharge casting is arranged to permit the oil to be pumped up past the motor, and also permits of enclosing the entire unit within a steel frame in order to protect all parts of the pump against damage when lowering into the vessel, or in raising it. The motor shaft and pump shaft are connected by a solid coupling, the entire weight being carried on the thrust bearing of the motor, which is designed to take care of the additional load.

This unit is not only used for pumping vegetable oils, as originally contemplated, but for lubricating and crude oils as wells.

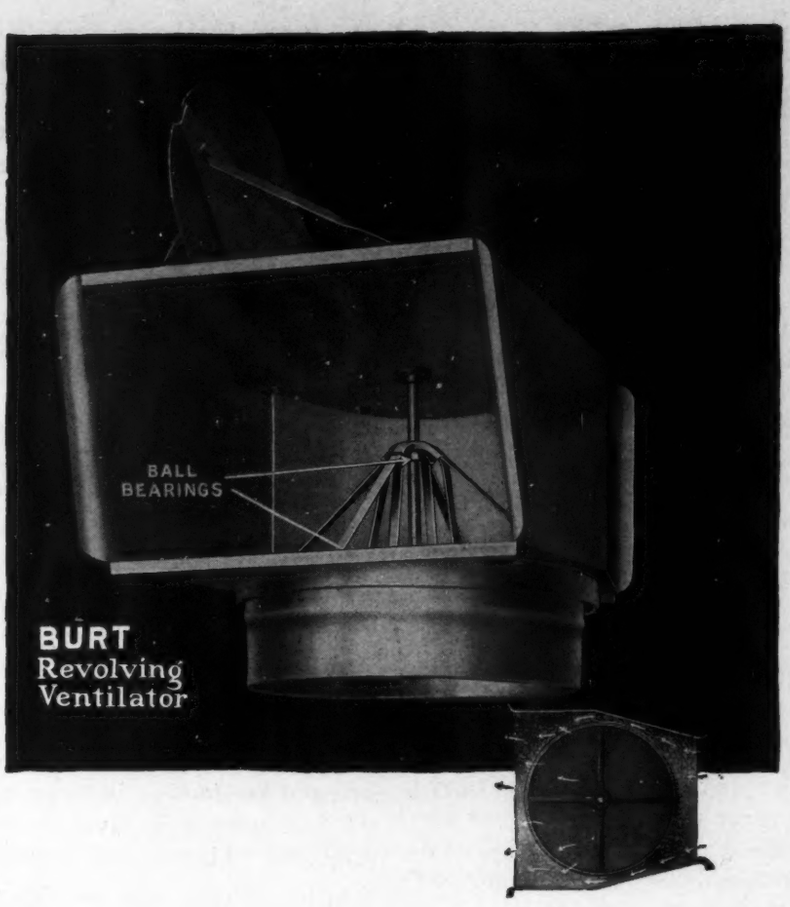
Many new developments and added refinements have improved the oil unloading pump since this installation. For instance, all impellers are hand finished and balanced hydraulically and dynamically. The pump shaft to which impellers are keyed is of stainless steel. A patented automatic stuffing box incorporated in the top case prevents pressure developed by the pump from entering the inner column. The Byron Jackson construction provides an inner tube, which encloses both the shaft and bearings, excluding water and other foreign matter, and affording positive lubrication. The inner tube is installed under tension, insuring perfect shaft alignment. Removal of the motor cap permits adjustment of the rotating element from the top without moving any other parts of the pump.

Pictures attached hereto were taken just after the pump had completed the unloading of five cars of Pennzoil, this being the first shipment of lubricating oil to come in bulk to Portland by boat. The tank cars were loaded and transferred to the Pennzoil plant just north of Portland. The capacity of the pump is 500 gallons per minute, and an 8140-gallon tank car was filled in approximately 15 to 16 minutes.





The pump above and below deck



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Its design and open back construction cause air currents to pass not only over the top and sides of the ventilator but also allow them to pass directly through the head. This, together with the partial vacuum on the lee side of the ventilator (caused by the large hood construction), greatly increases the pulling power and holds the ventilator steady with the wind.

The Revolving ventilator is but one of the complete line of Burt ventilators. There's a size and a type for every condition. Our engineers will gladly show you how to obtain the maximum amount of ventilation for your investment. Send them your problem today.

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VENTILATORS — OIL FILTERS — EXHAUST HEADS

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Cracking Patent Litigation Ended by Agreement

THE long war between the Dubbs interests and the companies that made up the Patent Club is ended.

Peace was signed Tuesday night, January 6, in the offices of Universal Oil Products Company, 310 South Michigan Avenue, Chicago, at a meeting at which representatives of Shell Union Oil Company and Standard Oil Company of California met with officials of Universal Oil Products Company.

At that meeting the capital stock of Universal Oil Products Company, consisting of 1000 shares, was sold to a new Delaware corporation, United Gasoline Company, formed for the purpose of acquiring Universal Oil Products Company's stock.

Following the consummation of this deal, representatives of Standard Oil Company (Indiana), Standard Oil Company of New Jersey, Standard Oil Development Company, The Texas Corporation, and Gasoline Products Company signed an agreement terminating all litigation and guaranteeing not to sue any of the companies party to the agreement or any of their licensees on the ground of patent infringement. Twenty-five million dollars was the sum paid for the Universal Oil Products Company stock.

Controlling interest in United Gasoline Company is owned by Shell Union Oil Company and Standard Oil Company of California, the balance being held by the former stockholders of Universal Oil Products Company.

One of the conditions upon which the deal was predicated was that Hiram J. Halle, president of Universal Oil Products Company, remain in charge as he has been for the last 15 years. Mr. Halle was made president of United Gasoline Company, and also remains as president of Universal Oil Products Company. The other directors of the United Gasoline Company represent Standard Oil Company of California and Shell Union Oil Company. They include J. C. Van Eck, president of Shell Union Oil Company, and Richard W. Hanna, vice-president of the Standard Oil Company of California.

Universal Oil Products Company prior to the consummation of the sale of stock collected $30,000,000 in royalties during the years 1923 through 1930.

The new deal brings tremendous benefits to American refiners by clearing the cracking patent situation and freeing them from the threat of attack on the ground of infringement by Standard Oil Company of New Jersey, Standard Oil Development Company, Standard Oil Company (Indiana), The Texas Company, and Gasoline Products Corporation.

None of the companies named except Standard Oil Company of California and Shell Union Oil Company are stockholders in United Gasoline Company, nor will they share in the royalties paid by any Dubbs licensees.

One infringement suit alone brought by Universal Oil Products Company against Standard Oil Company (Indiana), in 1916, has to date cost plaintiff more than $1,800,000. It is fair to assume that it has cost the defendant at least an equal sum.

The suit brought by The Texas Corporation against Warner-Quinlan Company, licensees of Universal Oil Products Company, charging infringement of the Adams patents by the use of the Dubbs process was excepted from the agreement to end all litigation. The Adams patents are owned by The Texas Company, and formed the cornerstone of the foundation upon which the "Patent Club" was built.

Testimony in this case was all in and the decision lay in the hands of Judge Runyon of the Federal District Court of Newark, New Jersey. It was felt by both sides that the oil industry was entitled to have the opinion of a court in this case.

Less than an hour before the final signing and delivery of papers in the deal, news reached the conferees of the decision in this case. Judge Runyan decided completely in favor of Warner-Quinlan Company and Universal Oil Products Company.

Although there was still time for any of the parties to the deal to withdraw from negotiations on the strength of this decision, none of them did, and the deal went through as scheduled.

Standard Oil Company of California and Shell Union Oil Company are the two largest licensees of the Dubbs process and their current royalty payments are very large.

By the purchase of paid up royalty contracts incident to the purchase of Universal Oil Products Company stock, they are relieved from further current royalty payments.

Universal Oil Products Company will continue to function as heretofore, under the direction of Mr. Halle as president, and J. G. Alther as vice-president. R. J. Dunham, vice-president, who has been with the company since its beginning, is retiring to devote his attention to his personal interests.

John J. Mitchell, Jr., of Chicago, the son-in-law of Mrs. J. Ogden Armour, who held so large an interest in Universal Oil Products becomes a vice president and treasurer, succeeding Mr. Dunham.

C. P. Dubbs, inventor, will continue his relationship with the company.

It is announced by Mr. Halle that Universal Oil Products Company will continue to operate on the broadest possible policy of licensing the Dubbs process freely all over the world. The extensive research and development work which had long been carried on by the company will be continued and enlarged in scope.

G-R Bentube Sections

From 1 to 822 units used by 159 plants

MANY users of G-R Bentube Atmospheric Cooling Sections have standardized on them because of their exclusive scale-shedding feature, which prevents scale from building up, no matter how poor the cooling water may be.

Others use these sections for various condensing and cooling services because of their adaptability and ease of erection, dismantling and transportation, which permits them to be moved about the plant as required by operating conditions.

Still others find their compactness and effectiveness an important aid in minimizing the space required for installation, permitting small basin area under cooling towers and small tanks for submerged operation.

These are some of the important advantages that explain the rapidly increasing use of G-R Bentube Sections.

If you are not now securing the benefits of this unique apparatus in your condensing and cooling processes, write for bulletins describing these sections.

The G-R Bentube Section is patented and it is our intention to prosecute all infringements. Suits, charging infringements of our patent No. 1,617,083 have been brought in the U. S. District Courts at Wilmington, Delaware, and New York, N. Y.

HEAT EXCHANGERS

CONDENSERS
Sub-cooling—Partial—Reflux
Shell-and-Tube, Atmospheric, and Condenser Box Types

COOLERS
Liquid—Gas—Jacket Water
Shell-and-Tube, Atmospheric, and Condenser Box Types

OIL HEATERS

LEVEL CONTROLLERS

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Heat Transfer Apparatus

New Natural Gasoline Specifications

ON December 10, 1930, the Natural Gasoline Association of America adopted new specifications for the grading of natural gasoline. These specifications are promulgated for immediate optional use in regard to all new business and are to become the sole official specifications subsequent to January 1, 1932.

Primarily the change from the old to the new grading system involves specifications defining the volatility of natural gasoline. The new grading system makes use of the Reid vapor pressure and the A. S. T. M. per cent evaporated at 140° F. The old grading system made use of gravity and distillation loss for this purpose. Altho minor changes have been made in other specifications for the interest of standardization, the chief change is in volatility specifications.

The following factors have guided the Natural Gasoline Association of America in its choice of volatility specifications:—

(1) The volatility specifications of natural gasoline should be drawn to provide the most useful information regarding the utility of the commodity for blending purposes. According to the present knowledge of motor fuels, they can best be judged in regard to their vapor locking tendencies by the Reid vapor pressure; in regard to ease of starting, warming up performance and accelerating ability, by the A.S.T.M. distillation temperatures at which 10, 35 and 60% are evaporated, respectively.

(2) Volatility specifications for natural gasoline can serve a subsidiary purpose if they also can be readily related to production yields.

(3) The old specifications, based upon gravity and distillation recovery, have proven unsatisfactory. Practically all natural gasoline now being marketed falls in old Grade AA. The variations in blending results within this predominant grade are of sufficient magnitude to justify the revision of the specifications. Products now "outlawed" by the old grading system are being advantageously used. The old grading system does not recognize the economic value of gasoline of reduced butane content.

(4) The utility of natural gasoline is most completely expressed by its composition, since all physical characteristics depend upon the proportions in which the individual hydrocarbons are present. At the present stage of laboratory technique, however, specifications for natural gasoline in terms of composition are unwieldly and unsatisfactory.

(5) Vapor pressure is the most important single factor in the use of natural gasoline. With the recent knowledge of the value of increased effective volatility of motor fuel, which can be obtained by the addition of natural gasoline, it is essential that marketers and users maintain the vapor pressure of the finished blends below certain limits. No matter how much effective volatility is desired in the finished blend, it can not be obtained within these limits if the vapor pressures of the blending materials are too high.

(6) As a means of differentiating between natural gasolines of the same vapor pressure but otherwise of widely differing characteristics, such as gravity and distillation data, it is necessary to provide a modifying specification. A single A.S.T.M. distillation point will serve for this modification. This point will definitely establish the influence of the natural gasoline upon the effective volatility of the finished blend, while the vapor pressure of the natural gasoline imposes limits upon the quantity which can be used.

(7) It has been stated that vapor pressure and a distillation point provide adequate information for blending natural gasoline. However, exact equivalency of natural gasoline, widely varying in these characteristics, is impractical. Therefore, the only method of grading available is to arbitrarily establish grades within the limits of present day commercial natural gasolines. These grades should be established with limits for vapor pressure and A.S.T.M. distillation points of small enough range to yield reasonably constant blending results.

(8) On the above basis, in order to include all the types of present day commercial natural gasolines (butane free, present grade gasolines and high gravity "outlaw" gasoline) and to keep the specification limits narrow enough to define utility, it is necessary and desirable to increase the number of grades considerably. It is to be expected that economic conditions will eventually, and probably rapidly, reduce the number of grades.

NEW SPECIFICATIONS

The new grading system for natural gasoline is described in the following paragraphs. The description includes all the specifications which apply to natural gasoline as well as to volatility specifications.

(Optional January 1, 1931 to January 1, 1932)
(Effective January 1, 1932)

Natural gasoline is a liquid petroleum product consisting of the heavy hydrocarbons extracted from

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Heat-resisting supports for Oil Stills

HYBNICKEL ALLOYS CO.

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Wilmington, Delaware

natural gas by such means as compression, absorption, and other processes.

Natural gasoline is defined further for commercial purposes by the following specifications:

1. Vapor pressure—10 to 34 pounds per square inch absolute at 100° F. (Reid).
2. Percentage evaporated at 140°F.—25 to 85.
3. Percentage evaporated at 275°F.—not less than 90.
4. End point—not higher than 375°F.
5. Corrosion—non-corrosive.
6. Doctor test—negative, "sweet."
7. Color—not less than +25 (Saybolt).

In addition to the above general specifications, natural gasoline shall be divided into 24 possible grades on a basis of vapor pressure and percentage evaporated at 140°F. Each grade shall have a vapor pressure range of four pounds and a range of 15 per cent in percentage evaporated at 140°F. The maximum vapor pressure of the various grades shall be 14, 18, 22, 26, 30 and 34 pounds respectively. The minimum per cent evaporated at 140°F. shall be 25, 40, 55 and 70, respectively. Each grade shall be designated by its maximum vapor pressure and its minimum per cent exaporated at 140°F., as shown in the accompanying table:

GRADES OF NATURAL GASOLINE
Percentage Evaporated at 140°F.

Vapor Pressure, Lbs. Per Sq. In. Abs. at 100°F. (Reid)	25	40	55	70	85
34	Grade 34-25	Grade 34-40	Grade 34-55	Grade 34-70	
30	Grade 30-25	Grade 30-40	Grade 30-55	Grade 30-70	
26	Grade 26-25	Grade 26-40	Grade 25-55	Grade 26-70	
22	Grade 22-25	Grade 22-40	Grade 22-55	Grade 22-70	
18	Grade 18-25	Grade 18-40	Grade 18-55	Grade 18-70	
14	Grade 14-25	Grade 14-40	Grade 14-55	Grade 14-70	
10					

The A.S.T.M. distillation point of 140°F. applies to barometric pressures of 740 mm. For other barometric pressures, the temperatures shown in the following table must be used instead of 140°F.:

754 mm.	141°F.	669 mm.	135°F.
740	140	655	134
726	139	641	133
712	138	626	132
697	137	612	131
683	136	598	130

Additional corrections shall be applied at the rate of one degree for 14.5 mm.

SIGNIFICANCE

The significance of the new grading system for natural gasoline is briefly described in the following paragraphs:

(1) The significance of the number names for the new grades is two fold: (a), the Reid vapor pressure of the natural gasoline in a given grade will not exceed the first number in the number name. The Reid vapor pressure can be four pounds less than this specified minimum value. (b). The effective volatility of the natural gasoline in a given grade will be at least that designated by the second number in the number name as applied to the 140°F. distillation temperature.

(2) According to a recent comprehensive survey the first seven of the following new grades comprised the bulk of the marketed production:

26-70 (Predominantly Grade AA)
30-70 (predominantly Grade BB, considerable Grade AA)
26-55 (predominantly Grade AA)
22-55 (predominantly Grade AA)
30-55 (Grade AA, C and BB chiefly)
22-70 (predominantly Grade AA, some Grade BB)
34-70 (predominantly Grade BB, some Grade C)
22-40 (Grades A and AA)
34-35 (predominantly Grade C)

In the above list the new grades are arranged in the order of gallonage encountered in the survey.

(3) The relationships of gravity and distillation loss to the new grading system are fairly well established by the preceding table. In general gravity bears a fairly close relationship to the percentage evaporated at 140°F., consequently purchasers of high gravity natural gasoline will probably select those grades which have high percentages evaporated at 140°F., and low vapor pressure limits. A more specific and detailed description of the relationship of gravity to the new grading system is in process of preparation and will be released in the near future.

(4) With the assumption that 15 per cent of natural gasoline will be used in blending operations, the four pound vapor pressure range of the new grading system is necessary to limit maximum variations of vapor pressure in the finished blend to one pound. For smaller or larger percentages of natural gasoline, the deviations vary accordingly.

(5) In order to control the 10 per cent evaporated temperature of a finished blend containing 10 to 15 per cent natural gasoline within 5°F., it is necessary, in conjunction with the vapor pressure ranges of four pounds, to establish grading intervals in the percentage evaporated at 140°F., of not more than 15 per cent. In controlling the portions of the distillation curve higher than the 10 per cent evaporated temperature, the quantity of natural gasoline used, rather that its quality, becomes increasingly the more important factor.

(6) The new grading system covers a much wider range in useful physical characteristics than the old grades and therefore should permit a freer play of supply and demand. By emphasizing quality of natural gasoline over a wide range, it is to be expected that economic conditions can more effectively dictate the quality as well as the quantity which will be used.

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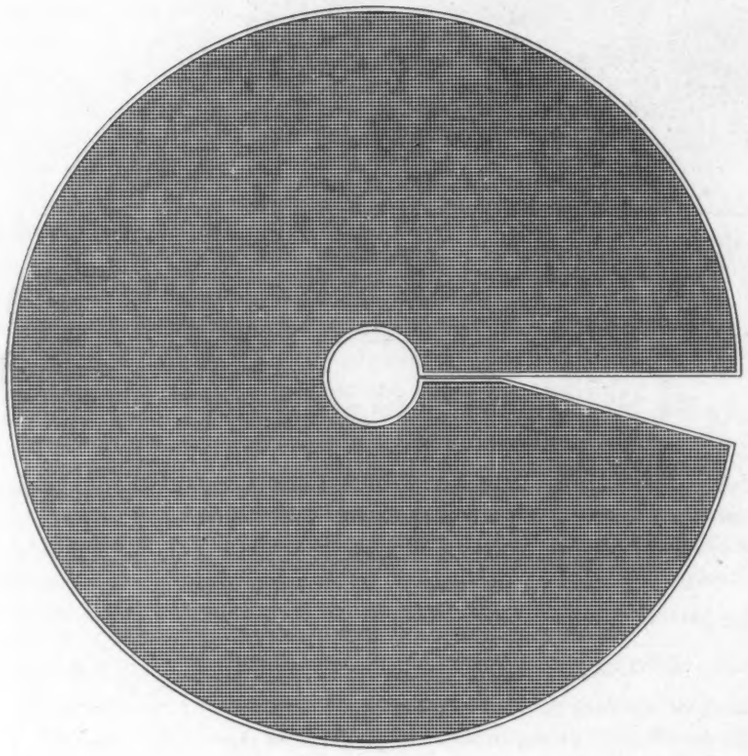
improve your percolating filters with one of these monel metal cloths:



the type illustrated is 7 feet in diameter, made of a single piece of 80 mesh monel screen, with a 6 inch center hole, to fit a dished perforated plate.

for added strength, this screen may be reenforced, top and bottom, with a 7 mesh monel screen, rolled smooth.

this combination is so constructed as to roll up easily to go thru an 18 inch manhole.

these filter cloths are furnished in any diameter to fit every type of filter. where severe sulphur corrosion is present, we furnish cloths made of ka2 stainless steel.

filter blankets of this type have been in continuous service for 18 months.

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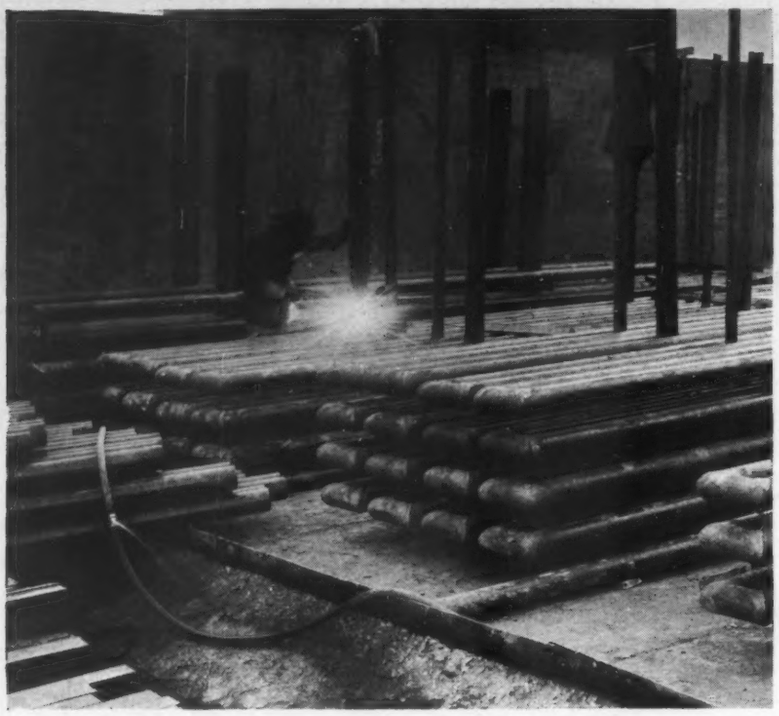


Fabricating a cooling box in large oil refinery. Welding current supplied by Lincoln "Stable-Arc" welders.

TRADITION

"I just noticed the superintendent coming out of your office after a long pow-wow.

What was the heated argument about . . ."

"About an hour on a cooling box he's just welded with Lincoln 'Stable-Arc' welders.

He wasn't selling me on the box, but on the fact that the welding was easier, quicker and he got better welds with the Lincoln's

I felt him out by saying that it was due to his better experience, but his comeback was that the variable voltage design, laminated magnetic circuit, separately excited generator field and double control of welding heat gives him a steady, uniform arc throughout the entire welding range.

He says that without that the best work can't be done by anybody.

He claims only the Lincoln 'Stable-Arcs' can give him those qualities.

I respect his judgment because of his wide refinery experience . . . and you know the refineries were the first branch of the industry to profit from the extensive use of arc welding.

In other words, refineries realize that their job is also to refine methods."

PROGRESS

THE LINCOLN ELECTRIC COMPANY

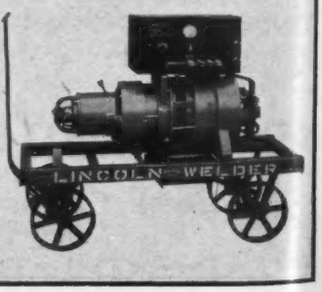
Department No. 34-1 Cleveland, Ohio

World's Largest Manufacturers of Arc Welding Equipment

W-167

LINCOLN "Stable-Arc" WELDER

Lincoln "Stable-Arc" welder, motor-driven portable truck type, for use where electric power is available.



PLANT MEN AND METHODS

By GEORGE REID

Alcotate, a Denaturant From Petroleum Research laboratories of Standard Oil Company of California have developed and perfected a new denaturant known as Alcotate for use in denaturing commercial industrial alcohol.

Alcotate is simply described as a complex chemical mixture derived from the gases produced in conjunction with the operation of the cracking processes operated by the company processing California oils. The chemical structure of the product has not yet been announced by either the producing company or the government, although its method of manufacture is reported to be similar to that of the alcohol plants of Standard Oil Company of New Jersey, Empire Oil & Refining Company and others engaged in the production of petroleum alcohols.

Dr. James M. Doran of the Bureau of Industrial Alcohol of the Department of the Treasury, in his announcement of the new product stated that alcotate would now replace methyl alcohol as a denaturing agent and that the new formula will provide for the use of one per cent alcotate and one per cent aldehol (another petroleum product) instead of the four per cent methanol and aldehol as now used. Studies of alcotate over a period of several months have shown it to be apparently proof against removal by the usual practices of filtration, distillation and the like. Alcotate denatured alcohol has the taste of putrid eggs and garlic, with the flavor of gasoline and chloroform and will make drinkers ill, but not dangerously so. Alcohol sold the public without permit, such as antifreeze mixtures is to be treated with alcotate. The largest consumers of denatured alcohol are the manufacturers of lacquers, paint thinners, solvents, and nitrocellulose, vinegar and ethyl acetate.

Oil Companies Control Universal Associated press dispatches under date of January 7, state that control of Universal Oil Products Company, liscensors of the Dubbs cracking process, has passed into the hands of the Shell Union Oil Company and Standard Oil Company of California through the purchase of 1000 shares of Universal for $25,000,000. In this deal the widow of the late J. Ogden Armour who backed the inventor of the process with an investment of three to four million dollars, received $8,216,058 for the 400 shares which was part of her husbands estate. The reports state that H. J. Halle who has been president of Universal Oil Products Company since 1921, will continue in that capacity. Thus the controlling interests of largest licseners of cracking units passes into hands of oil companies. Bureau of Mines survey of cracking units dated January 1, 1930, reports a total of 188 Dubbs cracking units at that time with a combined capacity of 238,500 barrels per day.

N. P. A. Plans Semi-Annual Meeting National Petroleum Association announces that its semi-annual meeting will again be held at Cleveland, this spring. The dates are April 23 and 24, with headquarters at the Hotel Cleveland.

The program committee consists of O. P. Keeney, chairman, G. C. Davison, A. M. Maxwell and C. G. Sheffield. Three of the association trustees, F. B. Fretter, Fred G. Clark and W. T. Holliday, residents of Cleveland, form the committee to arrange for the convention and entertainment. The annual fellowship supper will be held Thursday evening, April 23. Speakers on this program are to be outstanding men who will discuss subjects of timely importance to the oil industry. Details will be announced later.

S. A. E. Papers Interest Refiners Subjects of importance to refiners are scheduled for discussion at the five-day annual convention of the Society of Automotive Engineers beginning January 19 at the Book-Cadillac Hotel, Detroit. L. P. Saunders, Harrison Radiator Company, will present a paper at the sessions on fuel and lubricants dealing with the influence of oil cooling and oil coolers on lubricants. R. T. Haslam, Standard Oil Company of New Jersey, will present a paper at this session discussing the properties of fuels and lubricants made by the hydrogenation process.

The detonation session will be in the nature of a symposium at which papers will be presented by the following technologists: D. P. Barnard, Standard Oil Company (Indiana); D. B. Brooks, N. R. White and G. C. Rodgers of the Bureau of Standards; H. M. Campbell, W. G. Lovell and T. A. Boyd, General Motors Corporation's research laboratories; Graham Edgar, Ethyl Gasoline Corporation; and H. F. Huff, J. R. Sabina and J. B. Hill, Atlantic Refining Company.

W. P. R. A. Prepares For Convention R. R. Irwin, president, White Eagle Oil Corporation, has been appointed chairman of a committee which will arrange for the annual convention of the Western Petroleum Refiners Association. Other members are C. L. Henderson, vice-

president, Vickers Petroleum Company, and P. M. Miskell, manager refining and marketing departments, Empire Oil & Refining Company, according to a recent announcement by L. R. Crawford, president of the association.

A. S. Hopkins, president, Standard Oil Company of Kansas, and chairman of the manufacturing council of the W.P.R.A., has appointed a committee to arrange the program for the manufacturing group. This committee consists of E. A. Metcalf, superintendent of the Neodasha refinery of Standard Oil Company of Kansas; J. A. Sartori, general superintendent of refineries for Producers and Refiners Corporation; and, H. W. Camp, general superintendent of refineries for Empire Oil & Refining Company. The program is to be devoted to papers and discussions dealing with matters of special interest to refinery operators. The time and place of the annual one-day meeting is to be announced at an early date.

Supply Men Elect Officers M. H. Kotzebue, Tulsa Boiler & Machinery Company, was elected president of the Natural Gasoline Supply Men's Association at a meeting of the directors held at association headquarters in Tulsa late in December. He succeeds M. F. Waters of Hanlon-Waters, Inc., Tulsa, who was elected treasurer of the association for the coming year.

A. J. Kerr, Pittsburgh Equitable Meter Company, was elected first vice-president and A. W. Burkett, Jackson Engineering Company, second vice-president. Ray E. Miller, secretary of the Natural Gasoline Association of America, with which the supply men's association is affiliated, was again elected secretary.

E. H. Triphaus, Taylor Instrument Company, was elected a member of the board of directors, succeeding J. B. McMahon, Foxboro Company, who recently resigned following his transfer from Tulsa to Foxboro, Massachusetts.

Committees will be appointed early this year to make preparations for the annual meeting which is held each year in conjunction with the annual convention of the Natural Gasoline Association of America, in May. The supply men's association was organized three years ago with its membership consisting of manufacturing and distributing companies serving the natural gasoline industry.

Frizell Made Eastern Manager D. Ralph Frizell who has been refinery manager for MacMillan Petroleum Products Company at El Dorado, Arkansas, for the past several years has been made general manager of the eastern division. This embraces all of the territory east of the Rockies in which the MacMillan Company is interested. The company operates refineries at Long Beach, California, Borger, Texas, and Norphlet, Arkansas, and maintains sales offices in El Dorado and Chicago.

Retiring Plant Superintendent R. M. Andrus, manager of plants Numbers 1 and 2 of Standard Oil Company (Indiana), retired from active service January 1, after serving the company since 1896. His first employment with the company was as a pumper's helper in the Whiting, Indiana, refinery where he worked in several departments, later as department manager. He was transferred to the Casper, Wyoming, refinery of Midwest Refining Company in 1920. Mr. Andrus expects to spend some time in travel, but will return to the refinery next summer for a short time to have charge of certain construction work.

Superintendent Retires with Annuity Edward H. Wright, who has been manager of the Olean, New York, refinery of Vacuum Oil Company for 27 years of the 40 he has served with the company has been granted retirement with an annuity by a recent action of the board of directors.

Mr. Wright began his services as office boy at the Rochester, New York, works, being later transfered to the harness oil department. Later and after serving in various departments he worked in the laboratory, and was then promoted to assistant superintendent. In 1903 he was made superintendent of the Olean, New York, plant. For several years he has served as a member of the manufacturing committee of the company and later as a member of the research committee, continuing as manager of the Olean plant.

Allison Made Lion Manager J. J. Allison has been appointed manager of the manufacturing division of Lion Oil Refining Company, El Dorado, Arkansas. He succeeds Sylvester Dayson formerly vice-president in charge of manufacturing for the company who recently resigned to organize his own refining company. Mr. Allison was formerly connected with Empire Oil & Refining Company, and was at one time vice-president in charge of manufacturing for Pierce Petroleum Corporation. He returned to this country from Europe last fall after an extended connection in European countries in charge of foreign operations for Arthur G. McKee & Company, Cleveland.

Refinery Manager Dies W. G. Hamilton, manager of the El Paso, Texas, refinery of Pasotex Petroleum Company, died suddenly at El Paso, December 27, 1930. He had been in charge of construction and operation of this company since its inception about three years ago. The company is a subsidiary of Standard Oil Company of California and prior to the erection of the El Paso plant early in 1928 Mr. Hamilton was superintendent of the latter company's refinery at Richmond, California.

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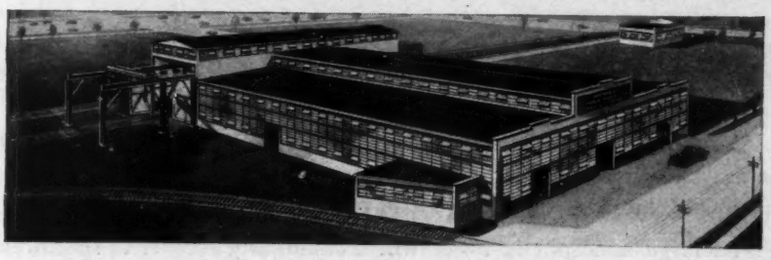

THE oil industry from coast-to-coast has come to recognize the advantages of piping that is fabricated by Midwest. There are several very good reasons for this unusual recognition.

Four well-equipped plants strategically located and manned by highly skilled organizations assure pipe fabrication that is accurately to dimension, promptly delivered and in every other way in accordance with the most modern practices. Economies result from the large scale operations. An unexcelled store of specialized piping experience is always available; this has frequently been responsible for simplification of piping design and substantial cost reduction. Developments to improve piping practices and extensive research to anticipate the piping requirements of tomorrow are constantly in progress—work that a small company could not profitably undertake.

Whenever you need fabricated piping . . . whether complete piping for refinery, natural gasoline plant or pipe line pumping station, or only a pipe bend, coil or welded header . . . it will be to your advantage to get in touch with the nearest Midwest office.

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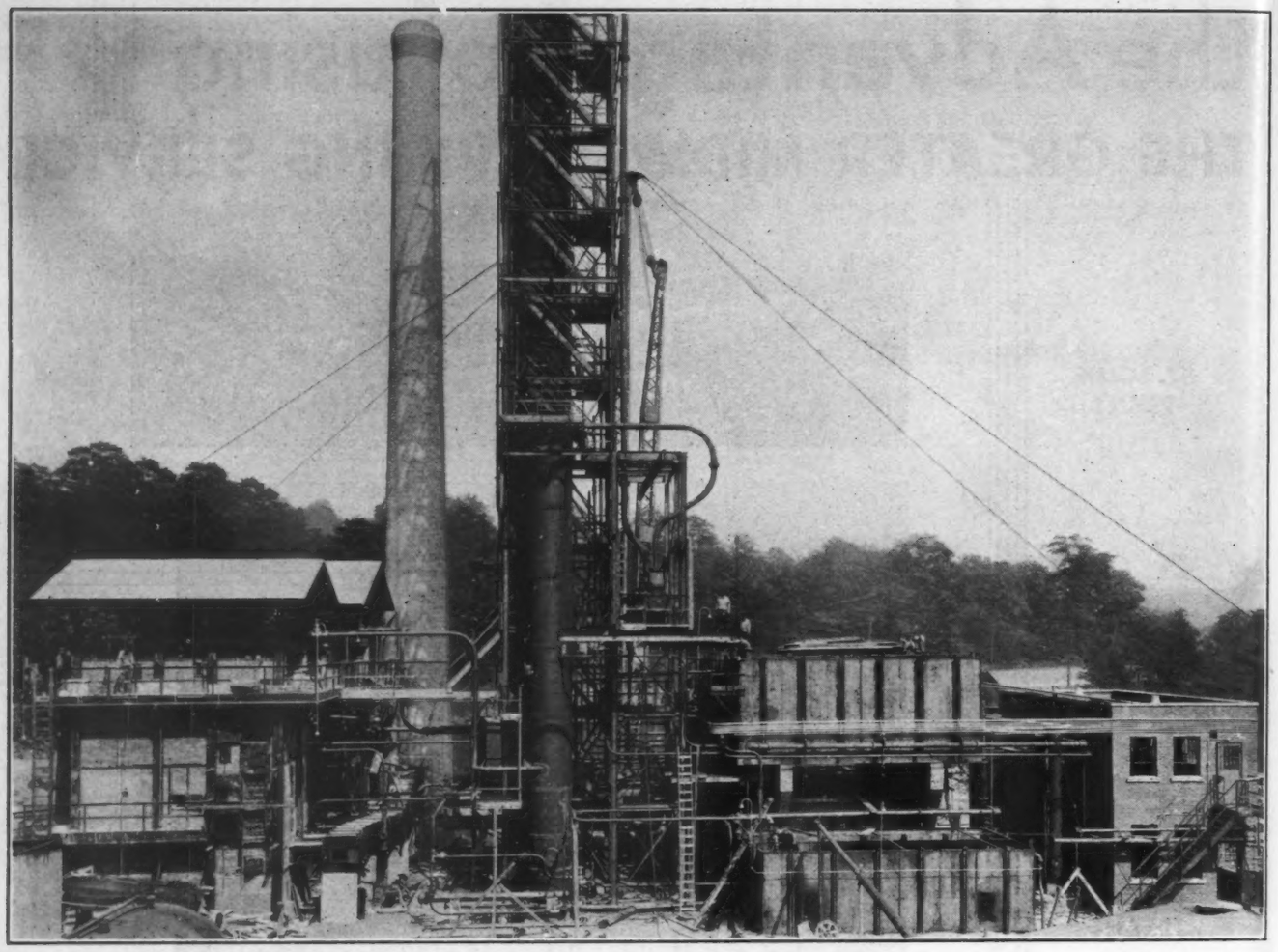
Offices: Chicago, 208 S. La Salle St. . . . Houston, 600 Bringhurst St. . . . Los Angeles, 520 N. Anderson St. . . . New York (Ballwood Div.), 30 Church St. . . . Tulsa, 733 Mayo Building



Flexible Distilling Equipment

A complete Foster Wheeler refining plant is here shown nearing completion. The tube stills are located at the left, and the tower for the crude unit is shown in the center with the rerun tower placed directly in front of it.

The large atmospheric tower will continuously recover to specification, gasoline from the top of the tower and six liquid side streams and bottoms, to meet varying market conditions. The rerun tower is arranged for the removal of an overhead vapor, one liquid side stream and bottoms, and has sufficient flexibility to rerun the de-waxed products from the atmospheric unit.

The compact and accessible arrangement of the entire equipment is characteristic of Foster Wheeler distilling units.

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FOSTER WHEELER

REFINERY AND GASOLINE PLANT ACTIVITIES

New Plants – Construction Notes – Personnel Changes

Expansion of Manufacturing Plants Continues

A REVIEW of the news of the month in the refining and natural gasoline industry shows continued activities in construction of new plants, in enlargement of existing facilities and in mergers or sales of plants in various refining districts.

From foreign countries comes news of the proposed erection of a 10,000-barrel capacity refinery in Peru by American interests operating as Peruvian Oil Corporation, and the proposed construction of a 1000-barrel plant at Edmonton, Canada, to be operated as Atlantic Keystone Petroleum Company.

New domestic refineries announced consist of two small plants in California where Vaqueros Major Oil Company proposes construction at Lompoc, and Haldey & Ellford plan a small refinery at Piru. Kettleman Hills Gasoline Company has completed its 1000-barrel skimming plant at Hanford, northern California, to run government royalty crude.

Gulf Refining Company is nearing completiton of its new plant at Neville Island, outside of Pittsburgh and nearly finished with the installation of new distillation and cracking equipment at its Toledo plant. It is reported the company contemplates additional refineries at Staten Island, New York, and Cincinnati. Reports also state that Prairie Oil & Gas Company will either enlarge its present refining facilities (operated by Producers and Refiners Corporation) or will acquire other plants.

White Eagle Oil Corporation has begun an extensive expansion program at its Augusta, Kansas, refinery to increase capacity to 15,000 barrels and including new cracking equipment. The small plant of Muenster Refining Company at Muenster, Texas, is being doubled in capacity. Orient Petroleum Company, Wichita Falls, after reorganization last month is to be known as Atlantic, Pacific & Gulf Refining Company.

Additional cracking units reported last month are being installed at Deep Rock Oil Corporation's Cushing, Oklahoma, refinery where a 4000-barrel Dubbs unit is under construction, and at the Greybull, Wyoming, refinery of Midwest Refining Company, where a 2500-barrel Cross unit is under construction.

Marathon Oil Company (formerly Transcontinental) has purchased the plant of Del Rio Refining Company at Del Rio, Texas, (capacity 4000 barrels daily) and is improving operating equipment. Dixon Creek Oil & Refining Company (McIlroy interests), has purchased the 3500-barrel skimming plant at Kingsmill, in the Texas Panhandle, which was originally Navajo Refining Company (later, Huber Refining Company). In Montana Milk River Refinery, Havre, was bought by Dr. B. A. S. Aronow who will operate after enlarging, and Northwest Stellerine Company, Inc., has purchased the Shelby Pipe Line and Refining Company plant at Shelby. Atlantic Refining Company has purchased the old 3000-barrel refinery at Texas City, Texas, formerly operated by Terminal Oil & Refining Company. The refinery of Peerless Oil & Refining Company, Chanute, Kansas, now in receivership will be sold this month. Texas Oil Products Company's refinery at Waxahachie, Texas, was sold by court order, December 20, 1930, to Guardian Trust Company, Detroit.

NEW GASOLINE PLANTS

New natural gasoline plants are reported at Shiprock, New Mexico, where Imperial Gas Company will build, and at the Lost Hills fields of Northern California where Geo. R. Getty, Inc., will erect a plant early this year.

Empire Oil & Refining Company is improving and enlarging its Asher, Oklahoma, gasoline plant and more than doubling capacity through additional equipment going in. Barnsdall Oil Company and Rio Grande Oil Company, joint owners and operators of a larger natural gasoline plant in the Elwood field, California, are again enlarging the plant through the addition of new equipment. Lone Star Gas Company has acquired seven more natural gasoline plants through purchase of properties from Chestnut and Smith Corporation. Plants are located in Eastland, Stephens and Coleman Counties in Texas. Standard Oil Company, California, has completed a third natural gasoline plant in the Kettleman Hills field with rated capacity of 100,000,000 cubic feet of gas daily.

Atlantic Buys Plant

Atlantic Refining Company purchased the 3000-barrel capacity skimming and cracking plant of the Terminal Oil & Refining Company at Texas City, Texas, effective January 1, 1931. This deal also involves a terminal with eight 55,000-barrel steel storage tanks that will be utilized in addition to the tank farm and tanker terminal being operated by Atlantic interests at Atreco, near Beaumont. No definite plans have been made to resume operations at the Texas City refinery by its new owners.

Canadian Refinery Planned

Atlantic Keystone Petroleum Company, Col. Frank Wilbur Smith, president, contemplates construction of a 1000-barrel refinery at Edmonton, Canada, according to a recent

REFINERY AND GASOLINE PLANT ACTIVITIES

announcement. A cracking unit is included in construction plans. Estimated expenditures reported $250,000.

Elwood Plant Enlarged

Barnsdall Oil Company and Rio Grande Oil Company recently completed extensive additions to their absorption plant in the Elwood field. A large evaporation plant for using ocean water was installed and used for a time, but this installation is now operating as a fresh water softener. Other additions included a 10,000,000-cubic foot Jackson absorber, two Southwestern heat exchangers, one preheater, one 35,000-gallon Jackson still, two circulating pump units, each driven by 100-horsepower electric motors and including lean and fat oil and cooling tower and dephlegmator water centrifugal pump, on a single shaft. Twenty-four compressors were also added, but they are used in gas lift operations as well as for gasoline plant purposes.

Dry Ice Plant

Carbon Dioxide & Chemical Company is building a small, experimental plant at its properties on Farnham dome near Price, Utah, where it plans to produce "dry ice" and liquid carbonic. The company plans to build a large, main plant on a railroad point in Carbon County, to be started early in the spring. The plant now under construction will be able to purify enough gas to produce 30 tons of ice per day, and is large enough to furnish the larger plant. However, the small test plant, which is an integral part of the refinery, will permit the production of only six tons every 24 hours. This amount will be adequate until the manufacturing is started on a large scale.

Deep Rock Expands Cracking

Deep Rock Oil Corporation, Tulsa, has contracted for the construction of a late type 4000-barrel capacity Dubbs cracking unit to be erected at its Cushing, Oklahoma, refinery. The company has been operating four Dubbs cracking units at this plant for several years. The new unit will be installed by Universal Oil Products Company. The refinery is a complete plant producing all usual petroleum products and has a rated capacity of 10,000 barrels per day.

New Refining Company Organized

Dixon Creek Oil & Refining Company was organized by McIlroy interests of Amarillo, Texas, in December under a Deleware charter with a capital stock of 350,000 shares of non-par value as result of the group having purchased a 3500-barrel capacity skimming plant near Kingsmill, Texas. This plant began operating last summer, and was originally called Navajo Refining Company, then changed to Huber Refining Company. The plant is deriving the bulk of its crude supplies from producing leases controlled by the McIlroy interests.

Empire Enlarging Asher Plant

Empire Oil & Refining Company is improving and enlarging its Asher, Oklahoma natural gasoline plant bringing capacity to 26,000,000 cubic feet of gas daily. Work under way includes installation of a new stabilizer unit, four additional storage units, the replacement of 16-inch cylinders with 18-inch cylinders and the addition of another absorber unit, making a total of three absorbers. Two new 200 horsepower Clark machines have been installed recently at this plant. Under former operation schedule 22,000 gallons of gasoline daily have been produced from about 12,000,000 cubic feet of gas.

Getty to Build Gasoline Plant

George F. Getty, Inc., is having plans drawn for the first unit of an absorption natural gasoline plant to be erected in the Lost Hills area of Northern California early in 1931, and upon completion of company wells now drilling to the deeper Temblor sand.

Gulf Plants Near Completion

Gulf Refining Company will complete construction of its new 6000-barrel refinery near Pittsburgh, on Neville Island about January 15, and will begin operating. The company's refinery at Toledo, with a rated capacity of 12,000 barrels daily is scheduled for completion and operation late in February. This plant is the old Paragon Refining Company refinery where the present owners have been erecting new distillation equipment and cracking facilities. The company is reported considering the construction of another refinery at Staten Island, New York. Upon completion of the new pipe line from Glenn Pool, Oklahoma, to Spencerville, Ohio, and connecting lines, the company is reported planning construction of another refinery at Cincinnatti, Ohio.

Small Plant at Piru, California

Hadley Refinery, being erected by Geo. S. Hadley, Pomona, California, and J. E. Ellford, at Cates Junction, west of Piru, California, with a capacity of 200 barrels per day is to be completed March 1. Cost is reported at $40,000.

Imperial Enlarging and Building

Imperial Gas Company is enlarging its Long Beach, California, natural gasoline plant and is building a new plant at Shiprock, New Mexico, to have a capacity of 3000 gallons daily. The company's third gasoline plant is located at Huntington Beach, California.

Kettleman Hills Refinery Operating

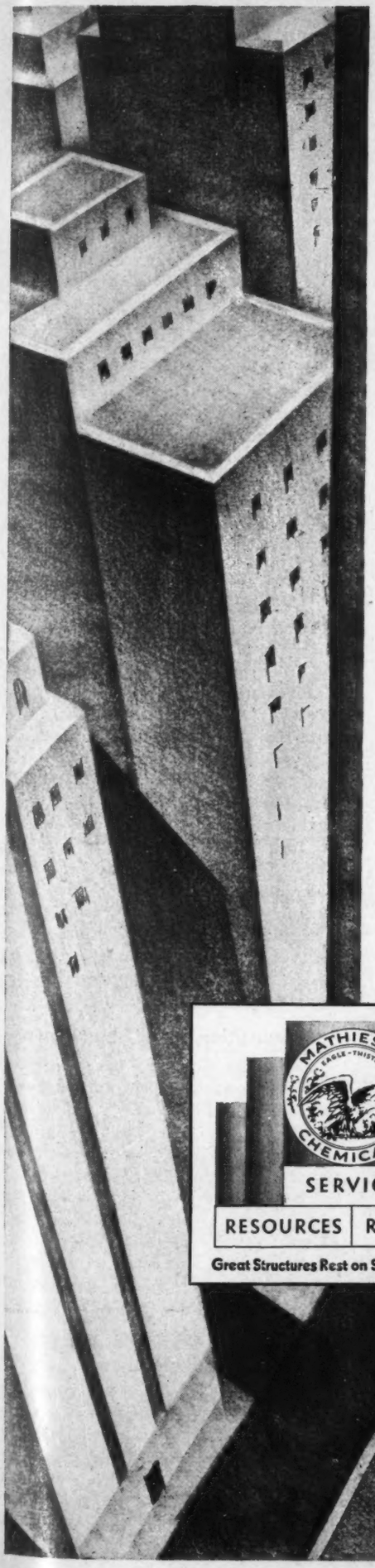
Kettleman Hills Gasoline Company has completed its skimming plant at Hanford, California, erected to process government royalty oil recently purchased by the company on a long time contract. Daily capacity is reported at 1000 barrels and crude it at present brought to the plant from the field 25 miles away, by truck. Plant production consists of gasoline and kerosene distillate. George W. Phillips is president of the company.

Lone Star Acquires Seven Plants

Lone Star Gasoline Company, subsidiary of Lone Star Gas Corporation, Dallas, acquired seven natural gasoline plants and other physical properties of Chestnut & Smith Corporation, Tulsa, in Central West Texas about January 1, 1931. These gasoline plants are located in Eastland, Stephens and Coleman Counties, and are producing about 105,000 gallons of gasoline daily. This purchase gives Lone Star a total of 15 plants in the district. Lone Star Gasoline Company obtained permit to operate in Texas late in 1930 as a Deleware corporation, having a capital stock of $750,000, and also 10,000 shares of non-par value stock. Oklahoma properties of Chestnut & Smith Corporation were not involved in this transaction.

Magnolia Dismantles Plant

Magnolia Petroleum Company is dismantling its 2500-gallon capacity absorption gasoline plant in the Chalk pool, Howard County section of West Texas, to be re-assembled at Bull



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By CARL R. MILLER

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REFINERY AND GASOLINE PLANT ACTIVITIES

Bayou, Louisiana, where the company already has a compression plant in operation.

Marathon Buys Del Rio Refinery

Marathon Oil Company, refining and marketing subsidiary of Ohio Oil Company, Findlay, Ohio, purchased Del Rio Refining Company's 4000-barrel daily capacity refinery at Del Rio, Texas, December 1, and is making a number of important changes in the operating equipment. The Del Rio plant has been operating since middle March, 1929, on Yates crude, which was obtained by contract from Mid-Kansas Oil & Gas Company, producing subsidiary of Ohio Oil Company. The latter owns about one-half of the producing acreage and potential crude production in the Yates field, thus supporting the Del Rio plant with one of the greatest crude reserves enjoyed by any single plant in the country.

Midwest Installs Cracking Unit

Midwest Refining Company has authorized the installation of a 2500-barrel Cross cracking unit at its Greybull, Wyoming refinery to operate on the heavier distillate below gasoline and kerosene distillated from Grass Creek, Hamilton Dome, Oregon Basin and other oil fields in that area. This addition will replace many of the old Burton stills formerly operated at this refinery. The plant has a rated capacity of 10,000 barrels.

Montana Refinery Sold

The Milk River Refinery, Havre, Montana, has been purchased by Dr. B. A. S. Aronow of Shelby, Montana, who will increase capacity to 400 barrels per day, producing gasoline, kerosene, distillate and residuum. Plant name will be changed to Aronow Refinery.

Enlarging Muenster Refinery

Muenster Refining Company, which has maintained a 100-barrel capacity skimming plant at Muenster, Texas, for several years, began enlarging the capacity to about 500 barrels daily late in December through the purchase of equipment from the old Buffalo Oil Company's plant at Sherman, Texas. Crude supplies for the Muenster plant will be obtained from nearby shallow wells. M. C. Hutton is the principal owner, and actively in charge of operations.

Michigan Refinery Operating

Naph-Sol Refining Company, successors to Muskegon Refiners, Inc., in the Muskegon, Michigan field, has begun operations after completion of remodeling and reconditioning the old refinery and increasing capacity to 1500 barrels per day. Additional fractionating equipment and tankage has been added. Jack Helme, formerly assistant superintendent of Old Dutch Refining Company, the largest local plant, is superintendent of the new Naph-Sol Refining Company plant.

New Montana Refining Company

Northwest Stellerene Company, Inc., a newly organized concern with headquarters in New York City, has purchased Shelby Pipe Line & Refining Company, Shelby, Montana, and will operate the plant as units of the Leamon Cracking process. The plant is the old refinery built by an organization of independent oil operators to run their own crude. The new company plans to continue processing the production of these operators who are known as Montana Producers Association.

Orient Reorganized

Orient Petroleum Company, Wichita Falls, Texas, has been re-organized and the name changed to Atlantic, Pacific & Gulf Refining Company, a Deleware corporation. This concern has a 2500-barrel daily capacity skimming plant located near Wichita Falls, and last year added a 1000-barrel capacity Jenkins cracking unit.

New California Refining Concern

Palisades Oil & Refining Company, recently incorporated in California, will operate a refinery completed a short time ago at Vinvale, California, on property adjoining the plant site of Rio Grande Oil Company.

Peerless Plant to be Sold

Peerless Oil & Refining Company's assets will be sold next month. The company has been in receivership for the past several months. Its chief assets consist now of a refinery at Chanute, Kansas with a rated capacity of 2500 barrels which has an appraisal value of $250,000. Sale has been ordered by Harry H. Fisher, Fort Scott, Kansas, referee in bankruptcy. The company's retail outlets were disposed of some time ago.

Prairie May Expand Refining Operations

Prairie Oil & Gas Company may expand its refining facilities and enter marketing of petroleum products on a larger scale according to interpretations of a statement recently issued by officials of the company and Prairie Pipe Line Company. Prairie Oil & Gas Company controls Producers and Refiners Corporation through a 71 per cent stock ownership acquired, some time ago, but whether expansion will come through additional refining facilities in this company or through acquisition of other concerns, is not known. The subsidiary company operates a 6000-barrel refinery at West Tulsa and an 8000-barrel plant at Parco, Wyoming.

Texas Refinery Sold

Texas Oil Products Company's refinery at Waxahachie, Texas, was sold by order of Federal Court in Dallas, Texas, December 20, to Guardian Trust Company of Detroit for $10,000. The latter concern made high bid on bankrupt sale of the properties nearly one year ago, but confirmation of the sale was deferred by the court in order to enable representatives of the defunct concern to try for a more attractive bid. The court hearing at Dallas brought out testimony that the Waxahachie plant originally cost $500,000. The plant is equipped with a single unit of the Ferro-Rammage cracking process, and never operated for any appreciable period.

Absorption Plant Shut Down

Skelly Oil Company has shut down its oil absorption plant in the Earlsboro pool of the Greater Seminole area, Oklahoma, and is utilizing its gas lift plant for the manufacture of natural gasoline by the compression method. Gas from 10 wells is processed to produce 10,000 gallons of gasoline daily. Residue gas is injected back into the wells at 300 pounds pressure. Yield is reported at 1½ gallons gasoline per thousand cubic feet.

Indiana Standard Merges Subsidiaries

Standard Oil Company, Indiana, has formed Stanolind Oil & Gas Company to take over all of the properties, assets and liabilities of Widwest Exploration Company in Texas, Dixie Oil Company and McMan Oil & Gas Company in all states in which they are operat-

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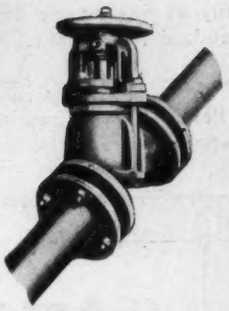

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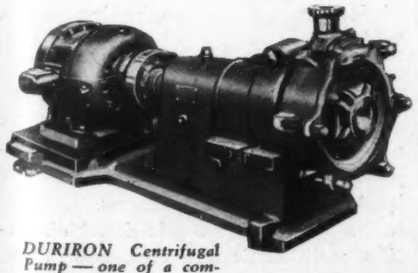

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ing, according to a recent announcement by Edward G. Suebert, president of Standard Oil Company (Indiana), Midwest Exploration Company will withdraw from Texas and Dixie Oil Company and McMan Oil & Gas Company will be liquidated. District offices already established by the three companies will be maintained by Stanolind Oil & Gas Company.

New Standard Plant

Standard Oil Company of California has completed and placed in operation a 100,000,000-cubic foot absorption plant at Kettleman Hills, the third to be built in this field by the company. The design was largely worked out by company engineers and the equipment is standard throughout.

Refinery in Peru

Peruvian Oil Corporation has completed plans for the construction of a refining plant on the Maranon River near Borza, Peru. Officials state that the capacity will be 10,000 barrels daily. The company is a subsidiary of Pacific-Amazon Railroad Corporation which plans to develop oil concessions and operate the refinery on the crude produced. W. R. Davis, M. L. Benedum and J. C. Trees, who have been identified with certain oil interests for several years in this country, are associated in the Peruvian project. Company headquarters are at 57 Williams Street, New York.

Large Edeleanu Plant

Union Oil Company recently completed and placed in operation a 900-ton Edeleanu plant at its Wilmington, California, refinery to meet increased kerosene demands from foreign countries. The new unit is capable of treating 7000 barrels of kerosene daily, making it the largest installation of its kind in the United States. The process is not new, but the capacity of the new plant has aroused additional interest in the purification of kerosene stock. The principal plant equipment was fabricated in Germany and shipped to the refinery. The imported items also included pumps, compressors, piping, evaporators, condensers and heat exchangers. The Edeleanu process purifies kerosene stock through the mixing of the crude product with sulphur dioxide at a temperature of about 15° F., the objectionable constituents being dissolved and settled out, while the kerosene flows out through the top of the mixers. The sulphur dioxide is recovered by evaporation, compressed and used again in the mixers. The building housing the new installation is 130 feet by 180 feet and is of sawtooth construction to obtain the best lighting effect.

Delay Refinery in Uruguay

Uruguay will not build a state-owned refinery as was proposed some time ago in a bill prepared by the National Administrative Council. The bill was withheld by the President of the Republic on the ground that the administration was not assured that profits would be sufficient to justify departure from past policy of leaving industrial enterprise in private hands.

Small California Refinery Planned

Vaqueros Major Oil Company is reported planning construction of a 1000-barrel skimming plant in the Lompoc, California producing district, due to its inability to secure satisfactory outlet for its crude. O. C. Fields Gasoline Company is reported to have contracted for natural gas production in this field.

White Eagle Enlarging Refinery

White Eagle Oil Corporation (Magnolia Petroleum Corporation) is expanding and making improvements at its Augusta, Kansas, refinery. Included in the program are additional distillation and fractionation equipment and new cracking equipment. The program of expansion will increase capacity to 15,000 barrels per day and will involve expenditure of approximately $2,000,000. E. B. Badger & Sons Company and M. W. Kellogg Company have been awarded contracts for construction of the new equipment. Additional men needed for the work have been employed.

American Petroleum Refining

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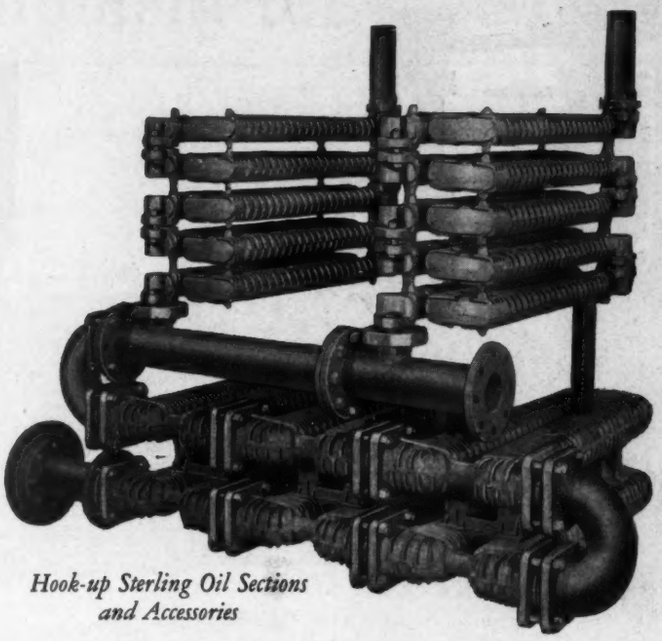

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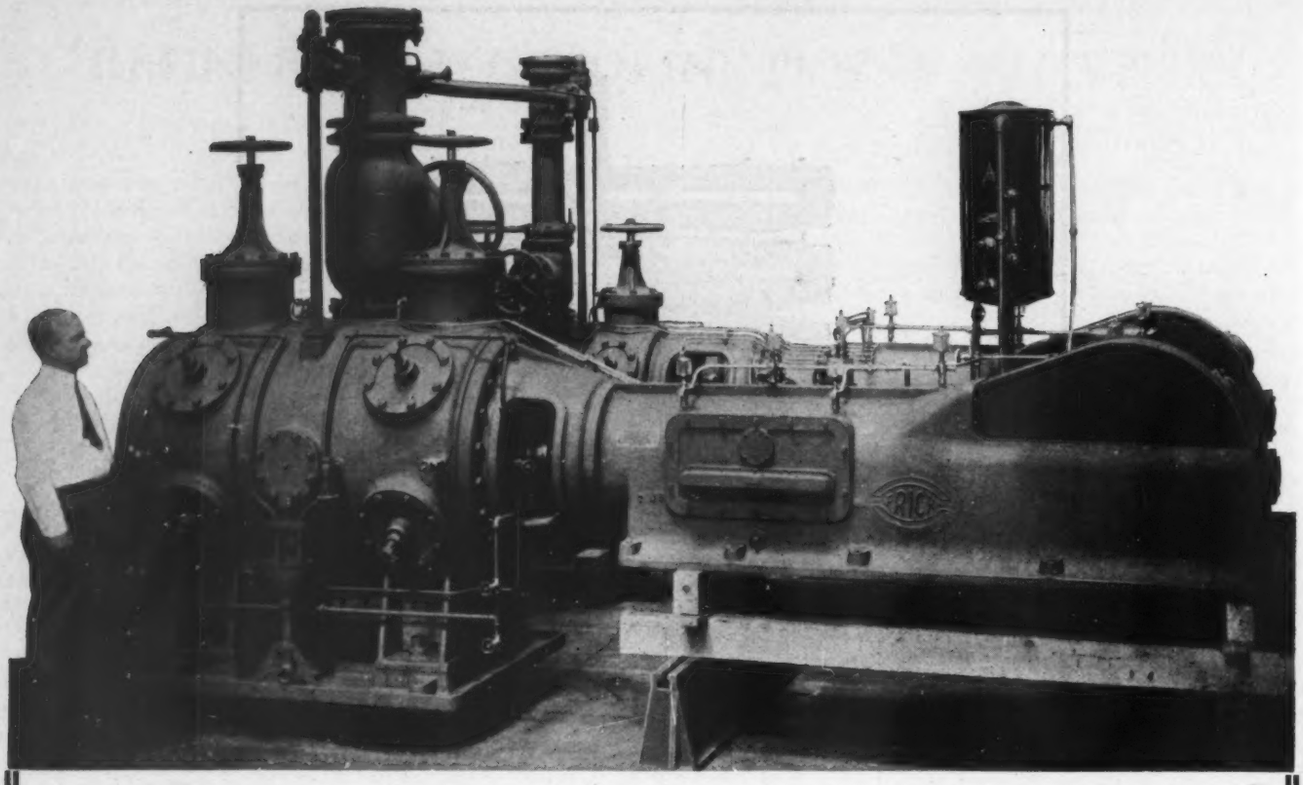

Two-stage Ammonia Compressor installed by Tide Water Oil Co., at their Bayonne, N. J., Plant

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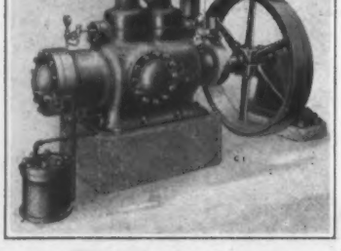

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Magnetic Controller

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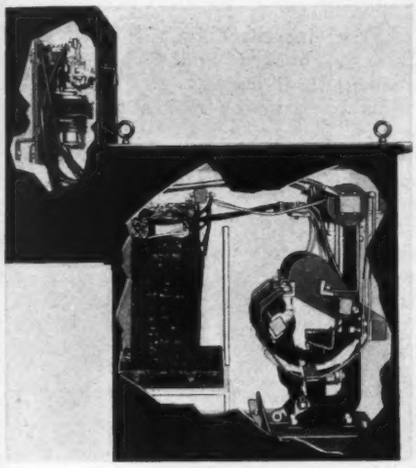
Electric Controller & Manufacturing Company, 2700 East 79th Street, Cleveland, Ohio, announces a new 2300 volt, full voltage magnetic starter, complete with overload relays and a self-contained potential transformer (to secure 220 volts for the control circuit) is intended for across-the-line starting of squirrel cage and synchronous motors and may also be used to control the primary of slipring motors. The starter is built for reversing, non-reversing and plugging applications.



Magnetic Controller

The design of this starter is radically different from the switchboard circuit breaker type of starter commonly used in the past for full voltage starting of high voltage A.C. motors. There are no bell cranks, toggle mechanisms or lever systems between the magnet armature and movable contact arm. The magnet armature, carrying the movable contact arm, is direct acting and is supported by only one large bearing pin and since the entire unit is totally oil-immersed, all working parts are always well lubricated and protected from dust and corrosion. This insures the equipment is ready for operation at any time, whether it is out of service for a few minutes or for several months.

The contacts used on this, the type ZHS full voltage magnetic starter, are likewise different from previous 2300 volt designs. They open and close the circuit with a wiping and rolling action, are duplicate and are easily renewable.

As illustrated, the enclosing case is a heavy welded steel tank, which houses the completely wired unit. A longer tank containing two type ZHS magnetic contactors, mounted back to back and mechanically interlocked, is supplied for reversing, non-reversing and plugging applications. This unit construction provides a flameproof, corrosionproof and dustproof installation that may be mounted anywhere with safety. It is not necessary to build an expensive control room for these starters. Frequently, it will prove very economical to mount them out in the plant alongside the motors they control, thereby permitting a very substantial saving in installation costs.

The type ZHS full voltage magnetic starters are available in two sizes, the No. 2 and No. 3 sizes, with maximum ratings of 600 hp. and 1200 hp. respectively. These starters may be controlled from a type "M" master switch which can be arranged to provide low voltage release or low voltage protection. The starters may also be controlled from float switches, pressure regulators, altitude regulators and similar actuating devices.

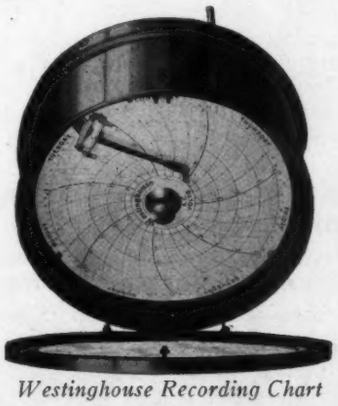
The manufacturers will gladly furnish more detailed information on this new product upon request.

Recording Chart

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

Westinghouse Electric & Manufacturing Company, East Pittsburgh, announces a new circular chart recording instrument, which is shown here. The instruments are light and small and have ammeters and voltmeters, and are made for switchboard mounting or as portable instruments

An example of the utility of these instruments is their use for determining the most economical use of motor-driven machinery, the loading of motors, time of starting in mornings or after lunch hour, time of quitting, loss of time, and power required for different operations or depth of cuts.

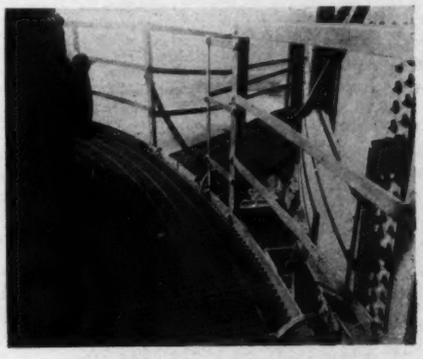


Westinghouse Recording Chart

They are designed principally for alternating current applications, but are also applicable to certain direct current services. The ammeters are available in sizes ranging from five to 50 amperes, and give a full-scale reading from zero to the value at which the meter is rated; the voltmeters are made in ratings varying from that which provides a scale of from 90 to 140 volts to that which records a maximum voltage of 550 volts.

This instrument uses for the measuring unit a small motor structure, in which a laminated armature core or "rotor" is mounted in the field of an electromagnet. The air gap surfaces of the pole pieces are arranged to give as uniform a scale as is consistent with good performance at light loads. The control force is provided by heavy springs. The main shaft operates the pen directly, and the mechanism as a whole is damped by means of an aluminum disk arranged to swing in the air gaps of a powerful set of permanent magnets.

Three kinds of clocks for moving the circular chart are provided; a key-wound, eight-day clock for driving the one-week charts; a key-wound, 36-hour clock for driving the one-day charts; and a sub-synchronous (self-starting) motor-driven clock, operated by the system frequency. Change gears are available to change synchronous-driven meters to other speeds.



Radial Steel Flooring

Radial Steel Flooring

TRI-LOK COMPANY

Dravo-Doyle Company, Pittsburgh, national distributors for products of Tri-Lok Company of that city, announces through its new catalog No. 1029 the new Tri-Lok radial open steel flooring, an illustration of which is shown here.

This radial flooring is made with the bearing bars placed radially and with circular cross bars. It is used for circular walkways, platforms, circular floors or manhole covers. The design of this new flooring is to eliminate cutting and banding, and to provide stronger and neater installation. The safety factor involved in the design and construction of the flooring is an outstanding feature in its use.

The class designation is the same as for the rectangular and radial types, except that the letter "R" is used, and the bearing bar spacing is that along the mean circumference. For example, "Class 1-R-3" indicates radial flooring

having a clear opening of one inch between bearing bars at the center of the span and three-inch center between the circular cross bars.

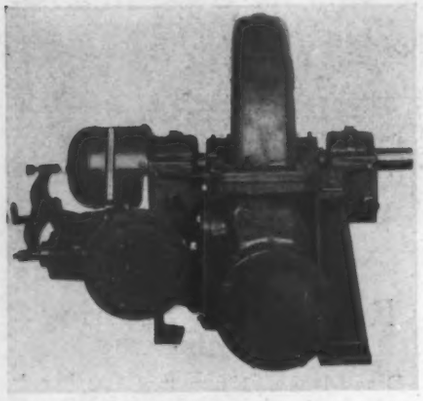
More complete information on this new product may be secured by writing Dravo-Doyle Company, Dravo building, Pittsburgh, or the H. A. Paine Company, Houston, distributors for Dravo-Doyle Company in Texas.

New Steam Turbine

GENERAL ELECTRIC COMPANY

General Electric Company announces another new, small, mechanical-drive steam turbine, designated Type D-58, for driving fans, pumps, and similar industrial equipment. The new turbine is designed for operation at steam pressures up to 250 pounds and speeds between 1200 and 4000 r.p.m., with capacities up to approximately 250-horsepower and is built only as a single-stage machine.

By limiting the range of conditions under which this turbine will be expected to operate it has been possible to decrease the length and width, making it a very compact unit with a considerable saving in weight. The turbine is supported at the center line to permit expansion without affecting the



G-E Type D-58 Steam Turbine

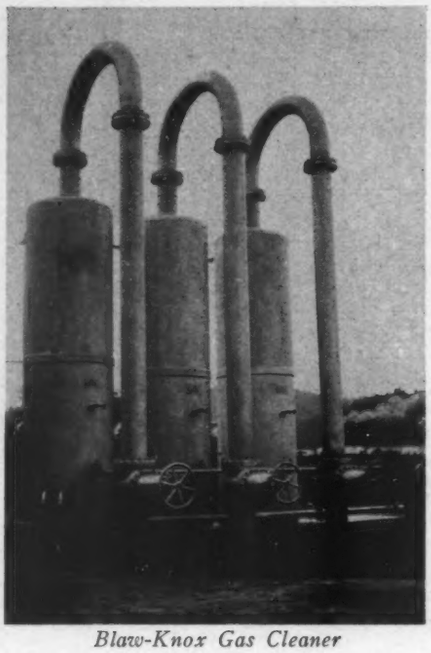
shaft alignment. It is equipped with speed regulating and emergency governors and is fitted with carbon shaft packing. The pipe connections are made to the lower half of the turbine to facilitate opening for inspection.

Gas Cleaner

BLAW-KNOX COMPANY

Blaw-Knox Company, Pittsburgh, offers improvements in its gas cleaner, which is illustrated here. Installed on the intake side of the compressor station, its job is that of protecting the valves cylinders, rings, piston rods and packing.

This gas cleaner, the basic principles of which were established by engineers of Empire Oil & Refining Company, with additional improvements by D. A.



Blaw-Knox Gas Cleaner

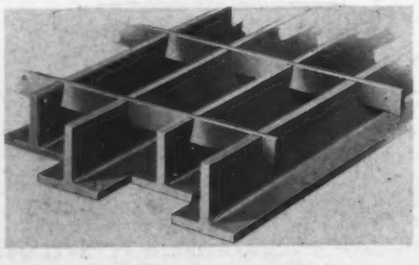
Sillers, superintendent of gas measurement of Lone Star Gas Company, is primarily a contacting and separating device performing the following two functions: Contacting dust particles with oil or other liquid, and separating oil with dust from the gas by contacting the surface plus centrifugal force. Gas entering the side inlet is blown by nozzles into a body of liquid, causing tremendous agitation and bringing the dust particles into intimate contact with the oil. Rising, the gas passes through the first separating head into the intermediate chamber, then into the final mist extractor, thence into the upper chamber and to the outlet clean and dry. Rundown pipes from each chamber carry the separated oil back to the main body of oil in the base of the cleaner.

More detailed information is available by writing the company for Form No. 1230, an illustrated booklet covering this product.

Reinforcing for Flooring

DRAVO-DOYLE COMPANY

Dravo-Doyle Company, Dravo building, Pittsburgh, announces the new T-Tri-Lok, a new type of steel reinforcing construction for concrete flooring. T-Tri-Lok is manufactured by Tri-Lok Company, for whom Dravo-Doyle Company is the national distributor.



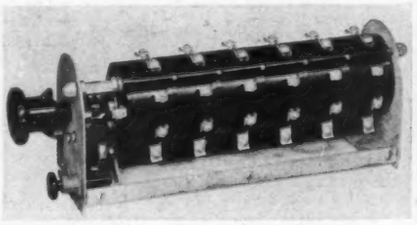
Tri-Lok Floor Form

This new construction is being used in and around refineries on loading platforms or wherever a self-supporting structure under heavy loads is required. The purpose of T-Tri-Lok is to make possible an increase in carrying capacity of a platform or floor with no more dead load on the structure itself.

T-Tri-Lok is manufactured with the triple lock under a 1600-ton press as are other Tri-Lok products, except that the main bearing bars are tees instead of flat bars. The strength of these tees is increased by the wedge action from forcing the cross bars into place and the load carrying capacity of the panel is further increased by the short columns of concrete under compression between the T-bars.

This construction makes the use of concrete forms unnecessary. The square edges of the steel when filled flush make the surface slipless and tend to prevent cracking or chipping of the concrete. When the wide panels are laid on the flooring beams, anchored as required, and filled with concrete or asphalt, the floor is complete. Such structure provides for an enormous lessening of the dead load on the entire structure.

Additional information on T-Tri-Lok will be furnished on request.



G-E Switch

Two New Switches

GENERAL ELECTRIC COMPANY

General Electric Company announces two new switches for use with multi-speed, changeable-pole motors. These bear the designations CR-2960-SY-108 and SY-113, the first being for use with smaller and the second, for larger sizes of motors. These switches, when used with multi-speed, squirrel-cage, induction motors, permit obtaining different speeds by changing the polar grouping of the stator coils.

For small motors one of these switches will serve as a starting switch as well as a pole-changing switch. In such cases, some form of under-voltage protection is recommended between speed points, such as is provided by most magnetic starting switches. The new switches can be used with two, three, or four-speed motors for con-

Standards for oil, gas, water, air, and steam service

FIG. 375
Bronze Gate Valve

FIG. 1444
I. B. B. M. Gate Valve

FIG. 102
Bronze Globe Valve

Series 1500
Cast Steel Gate Valve

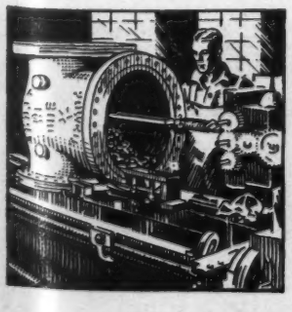
Series 600
Cast Steel Globe Valve

Series 400
Cast Steel Swing
Check Valve

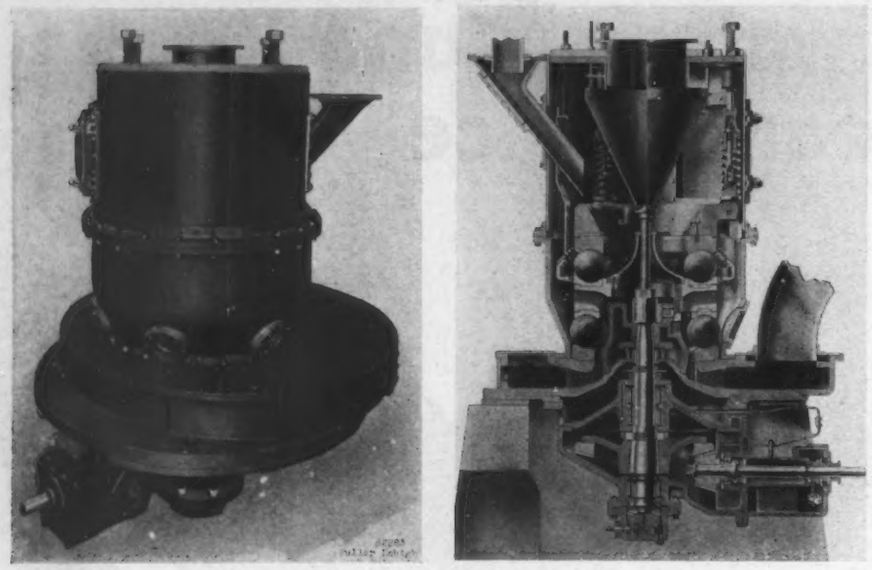
Powell Valves are designed and processed to be oil and gas tight. Their adaptability to dependably meet and satisfy pipe line and refinery needs accounts for the popularity of Powell Valves throughout the Oil Industry.

Powell Products include bronze, iron, and steel Globe, Angle, Check, Gate and Safety Valves; also Oilers, Lubricators, Grease Cups, Gauges, and other equipment for oil country service. They are distributed by jobbers in all oil sections.

THE WM. POWELL CO.
2521-31 Spring Grove Ave. Cincinnati, Ohio



POWELL VALVES



Fuller Leigh Company's Pulverizer

stant-horsepower or constant-torque service without change in mechanical construction.

Unit construction is used, making a wide variety of internal connections possible. This construction also makes replacement of individual contact assemblies possible. By removing tie rod spacers and compound space washers, the movable contacts are accessible for replacement without dismantling the switch.

In operation the speed point is selected by turning the knob handle to the desired position. Depressing the knob completes the main circuits and then picks up the magnetic line switch through the momentary disc contacts. The holding interlock is then closed and the switch latched in this position.

Pressing the "stop" button trips the holding interlock, dropping out the magnetic switch, and then opens the main contacts. Undervoltage protection is thus provided between speed points. Action is very rapid and positive.

Pulverizer

FULLER LEHIGH COMPANY

Fuller Lehigh Company, Fullerton, Pennsylvania, has recently placed on the market the new Type B pulverizer. It is an air separation ball mill, having the spherical ball and grinding ring principle of pulverizing in which fineness is not affected by wear of grinding parts, and the absence from the grind-zone of parts that require lubrication.

The new mill is so designed that the pressure between the balls and the grinding is obtained independently of the mill speed.

The grinding elements consist essentially of two rows of large diameter balls, two stationary and one rotating grinding rings. The rows of balls, one row mounted above the other, are separated and propelled by the rotating ring which is driven by and floats on the main driving shaft. Both the stationary and rotating grinding rings are made to gage in order to insure interchangeability. Grinding pressure between the balls and rings is applied and kept uniform by externally controlled steel springs mounted in the top section.

No lubrication is required within the grinding zone of the Type B pulverizer. All bearings and gears are sealed from the grinding zone and are lubricated by an automatic force-feed oiling system.

Operation of a Type B pulverizer is simple. Raw coal, crushed to pass through a ¾-inch ring, is fed to the mill from an overhead bunker by means of an independent drag feeder. It drops through the feed spout onto a rotating cone inside the upper row of grinding balls whence it is thrown outward into the path of the grinding balls by the centrifugal action of the revolving cone.

The principle of air separation used in the Type B pulverizer is such that fineness is controlled by regulating the air flow and varying the position of the adjustable sleeve inside the classifying cone. While tests have shown that it is not uncommon for 80 per cent of the coal pulverized in a Type B mill to pass through a 200 mesh screen and 90 per cent to pass through a 100 mesh screen, the mills are generally adjusted to obtain a fineness of 65-70 per cent through a 200 mesh screen and not over 2 per cent which will not pass through a 50 mesh screen. This latter degree of fineness meets satisfactorily the requirements of efficient combustion.

As the separating air currents sweep through the mill the fines are quickly removed from the grinding zones. The air streams move upward, inside and through the lower rows of balls and then outward through the cored holes in the intermediate ring. These changes in direction cause the coarse particles of coal to be returned to the lower grinding balls. A similar action occurs as the coal stream again changes its direction and sweeps upward to the top of the mill. An adjustable sleeve installed at the discharge opening of the mill prevents the coal stream from short circuiting passage through the classifying cone.

Type B pulverizers are built in capacities up to and including 40 tons of coal per hour. Its finish and workmanship are similar to that used on other high grade power plant equipment.

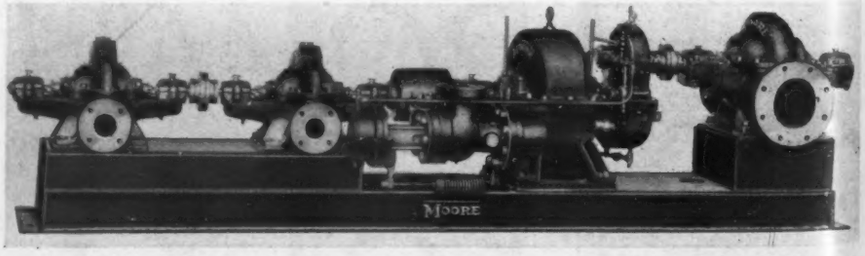
Water and Oil Circulating Unit

MOORE STEAM TURBINE CORPORATION

Moore Steam Turbine Corporation, Wellsville, New York, describes its new water and oil circulating unit as being designed primarily to reduce steam consumption from 25 to 40 per cent.

Reduction in steam consumption is accomplished by the use of the company's combined turbine and reduction gear.

As the fat and lean oil pumps operate at a comparatively high discharge pressure the best performance is in the neighborhood of 3500 r. p. m.,



Moore Circulating Unit

WATEROUS

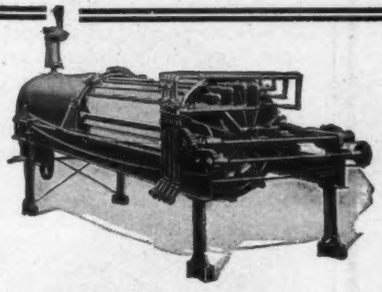
THE SIMPLE ROTARY PUMP

There are no radical features in the Waterous Rotary Pump. The age-old rotary pump principle has been refined and improved until it now holds its place alongside the centrifugal and piston type pumps in dependable performance, and excels either on applications for which it is recommended.

Waterous Dependable

Agents in Principal Cities
WATEROUS COMPANY
St. Paul, Minnesota

ACCURACY IN MANUFACTURING



Pressure Still Residuum

. . . loss or profit?

WHILE it may not be a good point to run more crude at this time, it is a good point to get more returns from the crude being run.

Handling pressure still residuum the Oliver United way adds more revenue. It turns a worthless waste into a marketable product. Write for details.

OLIVER UNITED FILTERS INC.

JOHANNESBURG E. L. Bateman
TOKYO American Trading Co., Inc.
MELBOURNE Fyvie and Stewart
HONOLULU W. A. Ramsay Co.
MANILA The Edward J. Nell Co.

Factories: Oakland, Calif., Hazleton, Penna., Peterboro, England
Cable Address: OLIUNIFILT

TIMMINS, ONTARIO B. D. Kelly
HALLE, GERMANY Wilhelm Lill
SCHEVENINGEN, HOLLAND and SOERABAIA, JAVA Van Leyvels and Co.
RECIFE, BRAZIL Ayres and Son

SAN FRANCISCO Federal Reserve Bank Building
NEW YORK 30 W. 42nd St.
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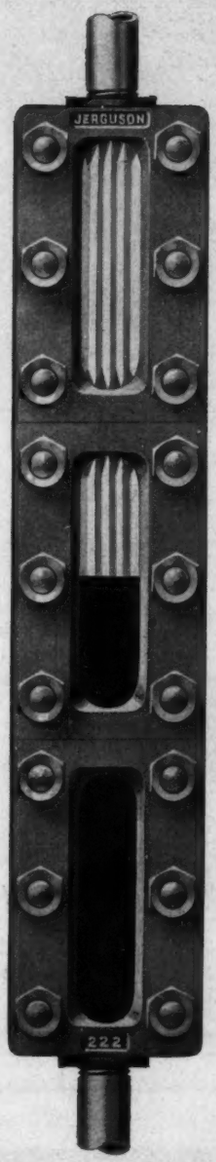
JERGUSON

REFLEX GAGES

have been used for steam boilers for 25 years and are now being used by leading oil companies for indicating oil levels in tanks, towers, stills, etc.

The *empty* space appears WHITE



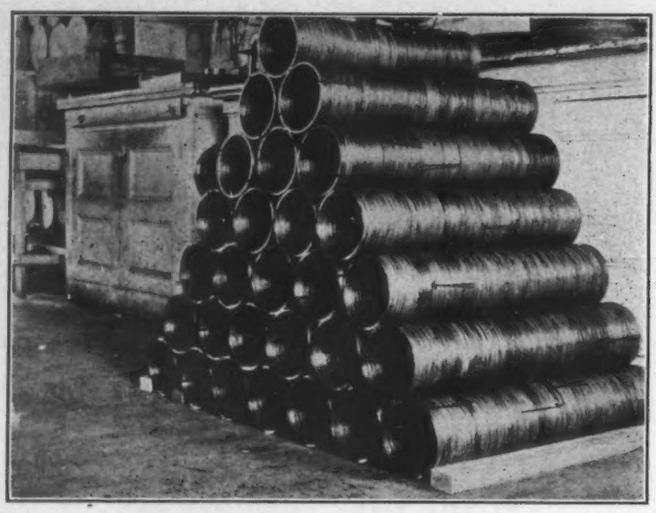
The *liquid* shows BLACK

They are safe and durable at the highest pressures and temperatures. We can furnish gages with or without valves for every type of service. Full information upon request.

Jerguson Gage & Valve Co.

87 FELLSWAY
SOMERVILLE, MASS.

METALLO
COPPER RINGS



One Shipment of 4,704 Copper Rings, 3/16 inch thick.

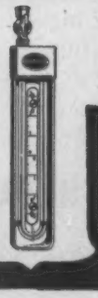
Among the many types, kinds and sizes of gaskets made by the Metallo Gasket Company, copper ring gaskets are included. These are made from soft annealed copper, machined smooth and true all over. They are furnished in all desired sizes, and prices are reasonable.

Irregular shaped gaskets, metal-asbestos filled, are manufactured on order. Special shaped solid aluminum gaskets can be furnished. Washers or solid gaskets of lead, aluminum, brass, copper, steel, Armco Iron or other material furnished in all sizes.

Whatever your gasket needs, take advantage of the Metallo reputation for high quality, prompt service and moderate prices.

Write for catalog and prices.

METALLO GASKET CO.
NEW BRUNSWICK—NEW JERSEY



Manometers
THE MERIAM CO.
1954 West 112th St., Cleveland, Ohio

the most efficient speed to run the steam turbine. As the water pump operates at a lower head its best operating speed is in the neighborhood of 1750 r. p. m. By using the combined turbine and reduction gear and driving the mineral seal oil pumps from the turbine shaft direct and by driving the water pump through the reduction gear all of the pumps are operated at their most efficient speed and likewise the turbine is also operated at its most efficient speed.

The turbine is equipped with a hydraulic variable speed governor by means of which the speed of the entire unit can be changed while the unit is in operation. By changing the speed of the unit the head and capacities of the various pumps can be changed to suit actual operating conditions. The entire unit is built and tested by Moore Steam Turbine Corporation.

Further details as to performance and bulletins describing the details of the unit may be secured by writing the manufacturer.

Oxygen Welding Regulator

OXWELD ACETYLENE COMPANY

The Oxweld Type R-43 Oxygen Welding Regulator, recently introduced by Oxweld Acetylene Company, 30 East 42nd Street, New York, guarantees a freedom from fluctuation by means of a system of two-stage pressure reduction. This two-stage reduction is accomplished through two separate and independent sets of diaphragms, valves and springs. The full cylinder pressure of 2000 pounds enters the regulator through a stem-type valve and is controlled by the first stage diaphragm. In this stage the pressure is reduced to less than 250 pounds per

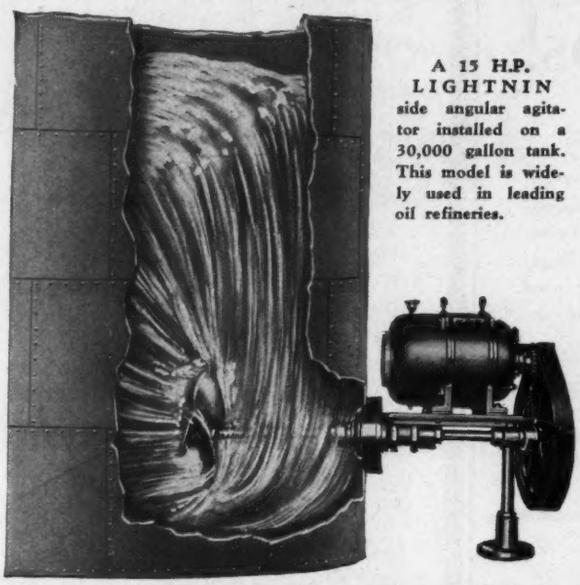
Oxweld Welding Regulator

square inch. This pressure will be constant for any one regulator, but varies somewhat with different regulators. The pressure here is non-adjustable.

The oxygen then passes from this first reduction assembly to a second stem-type valve and diaphragm assembly where the pressure is reduced to the working pressure desired by the

LIGHTNIN 6 POINTS *of* SUPERIORITY

SIDE ANGULAR AGITATORS FOR FIXED INSTALLATION



A 15 H.P. LIGHTNIN side angular agitator installed on a 30,000 gallon tank. This model is widely used in leading oil refineries.

(1) Eliminates baffle plates and mixing machinery that use valuable space inside your tank.

(2) Simplicity in construction means less first cost, fewer wearing members . . . fewer trouble sources . . . almost no upkeep expense.

(3) No ponderous mixing machinery to turn! Every cent of operating cost converted into mixing energy.

(4) Patented Off-Center principle provides unique double action . . . a combined rotation and turnover of the mix at the same time from bottom to top.

(5) Explosion Proof Motors tested and approved by Underwriter's Laboratories provided for inflammable or explosive materials.

(6) Easily installed in your present tank equipment whether open or closed, round or rectangular.

MIXING EQUIPMENT CO.

INCORPORATED

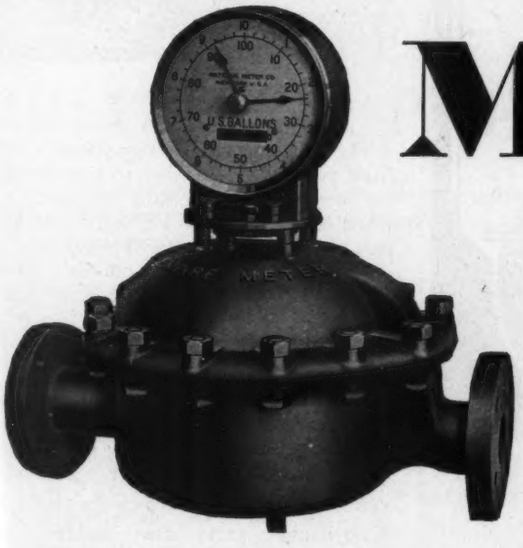
Originators and Largest Manufacturers of Portable Electric Mixers

New York Office and Sales Rooms

229 EAST 38TH ST., NEW YORK CITY

Factory—1040 Garson Ave., Rochester, New York

METERS



For Accurate Measurement of Oil at any Stage of Refining, Shipping, Storage or Selling.

The EMPIRE

A Positive Displacement Oscillating Piston Design

Highly accurate. Strong and durable. Easy to install. Economical to maintain. Simple to operate. Requires no complicated servicing. Made in all sizes, from 5/8" to 6", in standard (150 lbs. working pressure to square inch) and high pressure (300 lbs. and up) types.

The EMPIRE is different from every other type of meter offered for oil measuring work. The action of its measuring unit is a gentle, almost floating motion, with balanced pressures and a minimum of friction. This unique design enables the EMPIRE to hold its original high accuracy under operating conditions that quickly destroy the value of other types.

Send postal for fully descriptive pamphlet 125-R.

National Meter Company

299 Broadway, New York

Branches in all principal cities.

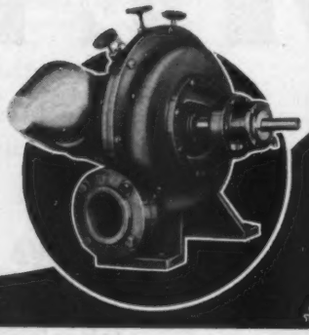
Give Them the Hard Jobs!

Put Coppus Turbines on the hardest jobs . . . . where service is most severe. Make them "prove their mettle"! They'll come across every time. On draft fans, recirculating fans, centrifugal pumps . . . . wherever steam drive can be used Coppus Turbines will adequately meet the demands for all heating and process work.

Turbine wheel is of the two row velocity stage impulse type . . . buckets are of non-corrosive and non-erosive metal and are cast into the wheel by a patented process. Valve and governor are of unique design and insure easy speed control . . . . Exhaust steam is free from oil and can be readily used for process work.

Coppus Engineering Corporation
360 Park Avenue
Worcester, Mass.

Our Bulletin 120-2 prepared especially for Oil and Gas Manufacturers tells about Coppus Turbines in detail. We will gladly send you a copy on request.



KERLOW GRATING

FLOORS, STAIRS *and* LADDERS

KERLOW STEEL FLOORING COMPANY
220-22 CULVER AVE., JERSEY CITY, NEW JERSEY

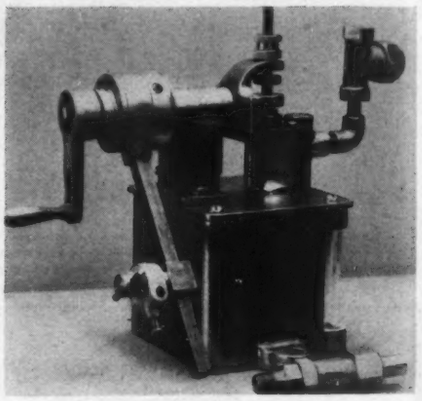
operator. This pressure is regulated by the operator by means of the adjusting screw, and any operating pressure may be obtained without fluctuation.

Instead of the usual handle-type pressure adjusting screw found on all other Oxweld regulators, there has been substituted a screw with a ribbed cap. This radical change in external design not only presents a neater and more compact appearance but will also avoid the possibility of breakage as there are no projections on the handle to be bent accidentally. This new type adjusting screw is of smaller diameter than the body of the regulator itself, so that it is easier to pack for transportation from one job to another.

K-K Drive Lubricators

HILLS-McCANNA COMPANY

Hills-McCanna Company's lubricators are now made with either the new K-K (Kam-Klutch) drive or the ratchet type of driving mechanism.



K-K Lubricator

The K-K mechanism comprises a right hand part which attaches to the standard for the purpose of holding the crankshaft when on the back stroke, and a left hand part which attaches to the driving rod operating the crankshaft on the forward stroke. The principle of the Kam-Klutch is spring held rollers embodied in a housing, which work with and against the crankshaft when operating.

The drive permits attachment to high speed driving arms in any position within the arc of a complete circle, and likewise gives the lubricator greater speed in oil delivery when and where needed. All Kam-Klutch parts are hardened and packed in grease for trouble free operation. The Kam-Klutch is interchangeable with the present ratchet drives.

Another feature included in the Kam-Klutch driven types of these lubricators is the new style charging arm or crank shaft for flushing cylinders when starting up or to increase flow when lubricator is in operation.

Further particulars are available by writing the manufacturer—Hills-McCanna Company, 2349 Nelson street, Chicago.

HOT OR COLD?

RIVETS

for

COLD DRIVING

Now available on short notice due to the recent installation of an

ANNEALING FURNACE

Complete Stocks of

CONE — BUTTON — PAN HEAD RIVETS

Carried in Warehouse Stock by

MAINTENANCE ENGINEERING CORPORATION

1400 Conti Street Phone Preston 2274

HOUSTON, TEXAS

Specialties for Pressure and Temperature

SHRIVER BLOTTER PRESS

Affords an economical and efficient means for removing dirt and moisture from oil and gasoline.

As a final finishing step before barreling or packaging, by passing the oil through a Shriver Blotter Press, the pipe line and tank accumulations of dirt and moisture are eliminated from the finished oil which assures an absolutely clean product.

Also, Shriver Blotter Presses are especially recommended for brightening up or polishing contacted oils.

Your inquiries are solicited.

T. SHRIVER & COMPANY

Established 1860

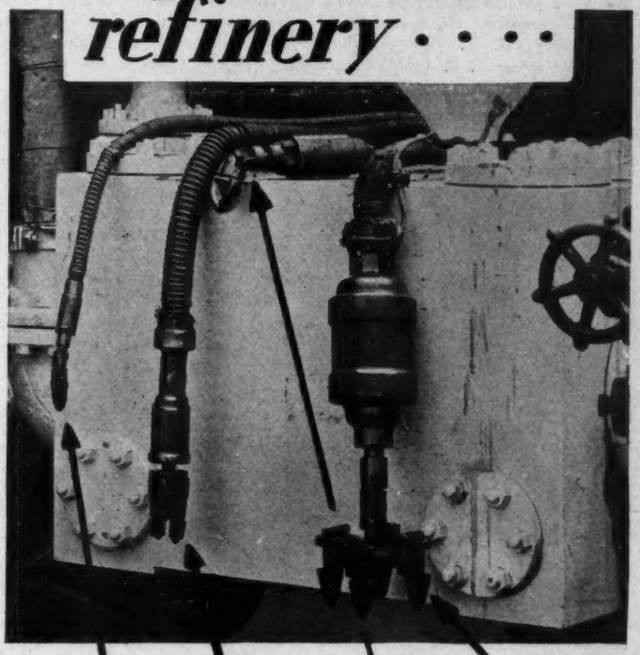
848 HAMILTON ST. HARRISON, N. J.

A FILTER PRESS FOR EVERY PURPOSE

SHRIVER

FILTER PRESSES FILTER CLOTH . DIAPHRAGM PUMPS

A close-up of tube cleaning methods in a representative refinery . . . .



LAGONDA CLEANERS

for 2 in. residuum lines	for 4 in. straight tubes in cracking still	for 4 in. horizontal return tubular boilers	for 8 in. vapor lines

In this refinery, the four Lagonda cleaners shown handle the tube cleaning job. Other refineries may have different problems in keeping their fouled tubes and pipes clear. In any case, Lagonda equipment can meet the need. Write us.

The Lagonda Mfg. Co.

SPRINGFIELD, OHIO

FUEL SAVING SPECIALISTS

NEW YORK, CHICAGO, PHILADELPHIA, BOSTON, PITTSBURGH, CLEVELAND CINCINNATI, DETROIT, SYRACUSE, BALTIMORE ST. LOUIS, KANSAS CITY, DENVER, DALLAS, ATLANTA, SAN FRANCISCO, MONTREAL, LONDON

X-1471

ITEMS ABOUT MANUFACTURERS

Alco Products, Inc., has been organized as a subsidiary of the American Locomotive Company, New York, to design, construct and engineer process plants and equipment for the oil refining industry. Officers of the new company have been announced as follows: William H. Woodin, chairman of the executive committee; William C. Dickerman, chairman of the board of directors; Joseph Davis, president; H. W. Swanson, vice-president in charge of engineering; G. T. Jacocks, vice-president in charge of sales; F. P. Brent, comptroller; J. O. Hobby, Jr., treasurer; and J. D. Finn, secretary.

C. A. FULMER

Ampco Metal, Inc., formerly American Metal Products Company of Milwaukee, Wisconsin, has opened a Mid-Continent branch office at 327 Exchange Bank building in Tulsa to serve the Southwest territory including the oil industry.

The Tulsa office will be in charge of C. A. Fulmer who will cover Oklahoma, Kansas, Texas, Louisiana, Arkansas and New Mexico for the company which manufactures acid-resisting metal products for producing, pipe line and refinery uses and also non-sparking tools for all purposes.

American Air Filter Company, Inc., of Louisville, Kentucky, have off the press a new bulletin containing complete information and engineering data on American air filters as used in connection with compressors and engines. This bulletin supersedes similar literature previously published by Midwest Manufacturing Company, Reed Air Filter Company and National Air Filter Company, distributors for American Air Filter Company, Inc. A copy may be had upon request to the home office, First and Central Avenue, Louisville.

The Bristol Company, Waterbury, Connecticut, has a new booklet off the press which is cut for insertion in a loose-leaf folder. It deals with Bristol's air operated controller equipment. This is catalog No. 4000, and a request for a copy of the booklet will be welcomed by the company.

J. H. Bunnell Company, 215 Fulton Street, New York City, has issued a 16-page booklet entitled "Gauging Fluid Levels Instantly, Safely and Automatically." It briefly tells the story in pictures and description of the MacCreedy fluid level indicator, an electrical remote control gauge, which automatically indicates the fluid levels of reservoirs or storage tanks within an accuracy of one-eighth of an inch and which gives continuous readings at one or more points 24 hours a day. A complete outline of how the MacCreedy fluid level indicator operates in practice is given with a mechanical drawing labeled to show the working of the parts. The workings of the transmitter, which is the heart of this gauge system, is also pictured and told. Illustrations are given showing the whole system on the job. J. H. Bunnell Company will supply a copy of this booklet upon request to the address above.

Coffing Hoist Company, 317 East Van Buren Street, Danville, Illinois, announces the publication of a 24-page booklet describing and illustrating Models A, F, F-S and Z hoists, a hoist for all purposes and types of work. Working illustrations of these various type hoists on the job are shown. Capacities and uses for the various types may be had by writing the company for a copy of this booklet.

Durametallic Corporation, Kalamazoo, Michigan, manufacturers of metallic packing, announces the appointment of R. O. Ayers of Ayers Engineering Company, Post-Dispatch Building, Houston, as sales and packing engineer for South and East Texas. Ayers' experience in selling and servicing refinery products in the Gulf Coast territory dates back a number of years.

Henry L. Doherty & Company has acquired the gas equipment division of Columbus Heating and Ventilating Company, manufacturers of warm air furnaces with factories located at Columbus, Ohio, for Surface Combustion Company.

Following the acquisition of Chapman-Stein Company by Surface Combustion Company, September 18, this purchase marks another step in the expansion program being followed which will increase the activities of this Doherty owned company to cover all branches of the manufacture of gas heating and cooling equipment for industrial and domestic purposes.

The Columbus company will come under the management of Frank H. Adams, vice-president and general manager of Surface Combustion Company, with headquarters at Toledo. No changes are contemplated in local personnel or management.

Edwards Valve & Manufacturing Company, East Chicago, Indiana, has issued a handsomely bound 144-page catalog devoted to describing and picturing its non-return, globe and angle, blow-off, fee line and atmospheric relief valves. Information on individual valves and parts are carried in detail, with prices. The design, construction and operation of Edwards valves are completely outlined in this catalog, a copy of which is available upon request.

Fuller Lehigh Company's manufacturing operations are to be transferred from Fullerton, Pennsylvania, to the Barberton, Ohio, works of Babcock & Wilcox Company. Management, engineering and sales departments will move to New York City. No definite date has been set for these changes but it is expected that they will be made early in 1931.

The corporate identity of Fuller Lehigh Company will be maintained, according to an official announcement, but in some cases the personnel will be merged with that of the parent company, Babcock & Wilcox Company.

Sales offices of the two companies are now located close to each other, and the erection and service departments of the two concerns have been combined for some time, so the change in location of Fuller Lehigh manufacturing, sales and engineering represents an important step in coordinating the activities of the two organizations.

E. G. Bailey, president of Fuller Lehigh Company has been elected a vice-president of Babcock & Wilcox Company.

The Foxboro Company, Foxboro, Massachusetts, recently issued Bulletin No. 170 on automatic flow controllers. It runs 40 pages and covers the complete field of flow control. It also includes ratio flow control, liquid level control and flow control under high pressures. This, the company's latest publication, may be secured by writing the company at 38 Neponset Avenue, Foxboro.

Foster Wheeler Corporation, 165 Broadway, New York City, has issued a new bulletin describing waste heat boilers of a different character from those used in the past.

The boilers consist of heating elements built of seamless steel tubes covered with cast iron extended surface, reamed to size and shrunk on the heating tubes. They are more compact per square foot of heating surface than has previously been possible. Those described are not new as several of them have been in operation for more than a year. The first installations were made in connection with the exhaust gases from Diesel engines. It has been found that in

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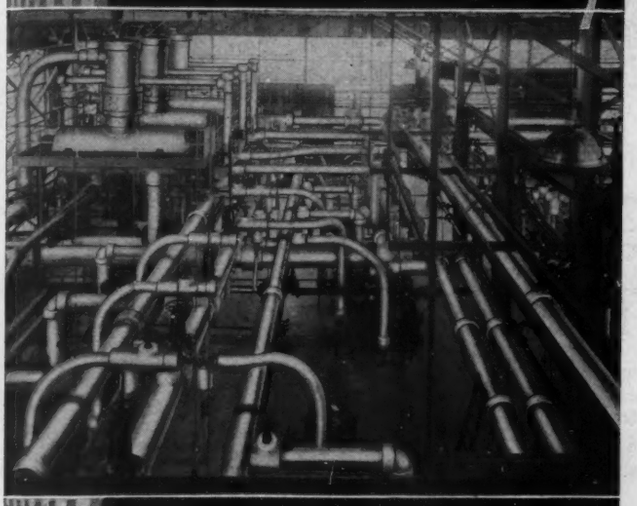
PIPING by



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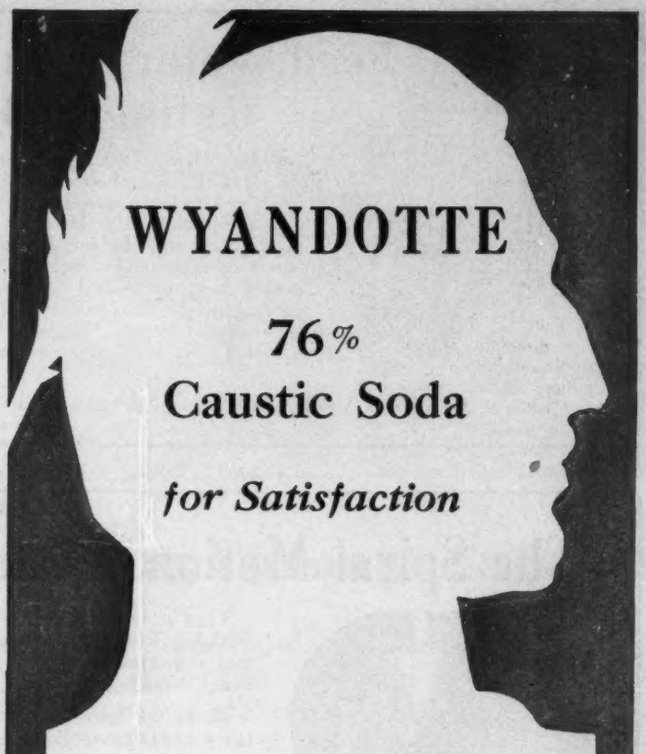
FOR EVERY OIL FIELD NEED

Refineries are exacting

To meet the ever-increasing requirements of this rapidly growing industry and to keep pace with the latest scientific achievements, refineries require the most modern equipment and give strict attention to maintenance and upkeep. Their demands are exacting—but it is a tribute to this organization that "POWER PIPING" has met their needs efficiently and economically through the years!

POWER PIPING COMPANY
PITTSBURGH, PA.

FROM A MERE FITTING
TO A COMPLETE SYSTEM



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for Satisfaction

INCLUDED automatically with every Michigan contract is our pledge that you shall be satisfied.

Quality maintained at a high standard, uniformity of product, prompt delivery even during emergencies—these are some of the necessary factors.

They are provided by Michigan's ownership control, from raw materials to rail and shipping facilities. Warehouses and jobbers are near you to provide for your routine or unexpected needs.

Also Soda Ash, Bicarbonate of Soda and Calcium Chloride.

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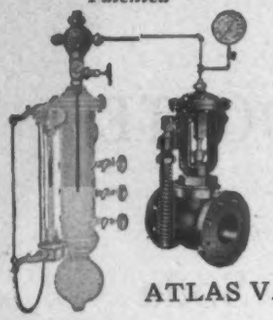
An Ideal Feed Water Regulator for Refinery Boilers

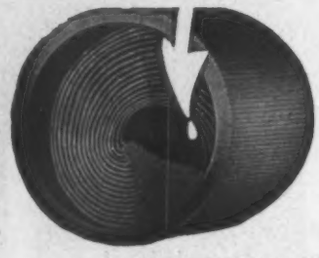
Patented



Ask for a list of some of the refineries now using the CAMPBELL Boiler Feed Water Regulator. It is positively guaranteed by us to fulfill every claim we make. It is priced at a figure within the reach of the smallest refinery as well as the largest. Get full information on what the CAMPBELL is contributing to boilers all over the world. No moving parts. No thermostats. No floats. No generators. Simple. Rugged. Dependable. Easily installed. No servicing required.

ATLAS VALVE CO., 275 South Street, Newark, N. J.

The Spiral Motion Is the Trick



That's why Hood's Chemico Spiral Packing Rings have been selected by so many engineers. The center hole prevents choking and clogging.

Made of acid-resisting shale—practically indestructible.

Used by all big producers because of the intensive movements.

Samples on request

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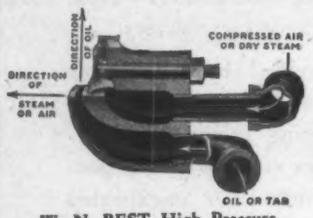

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dependable, efficient, economical, non-clogging atomizers of fuel oils, tars, acid sludges and still bottoms.

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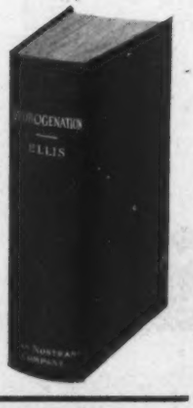
By CARLETON ELLIS

Starting with a clear account of the principles of hydrogenation catalysis, this book covers systematically the scientific work on the hydrogenation of individual organic compounds, and then presents exhaustively all the details of the industries themselves. The information in these pages has been compiled by the author over the many years of his career in this field. The researches, patents and inventions that have made him an outstanding authority on the subject of industrial hyrogenation tend to prove the value to you of this great book which has just been completed by the addition of new, hitherto unpublished information.

986 PAGES — 6 x 8½ CLOTH, ILLUSTRATED. PRICE — $15.00



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The GULF PUBLISHING COMPANY

P. O. Box 1307 Houston, Texas

Items About Manufacturers

this service the boilers act as excellent mufflers, no additional muffling devices being used under ordinary conditions.

Another interesting departure from usual boiler practice is that when operated with waste heat gases not exceeding 800°F., it is not necessary to by-pass the boilers for protection, even when dry. Repeated tests in operation have shown that the boilers are not damaged when used as mufflers alternately with and without water.

The boilers may thus be run as flash boilers, the steam production being controlled by setting the feed valve for the desired steam quantity. A further characteristic of much interest to operators is the self-cleaning tendency, it having been found that the exhaust gases from Diesel engines tend to keep the heating surface clean so that soot blowing is eliminated when operating on exhaust gases from internal combustion engines.

The catalog shows several designs, installations and details of construction which will be of interest to those having waste gases at temperatures above 500°. The bulletin is known as WB-30-2 and is available upon request.

Globe Steel Tubes Company, 3839 West Burnham Street, Milwaukee, announces the organization of a subsidiary company, Globe Stainless Tube Company, which will carry on a business of engineering, designing, and manufacturing stainless steel tubes and tubular installations for corrosion and heat resisting purposes. The principal officers of the new company will be the same as of the parent company, as follows: Paul J. Kalman, chairman; F. J. O'Brien, president; and G. D. Ross, secretary and treasurer. Sales will be handled through the same sales o..ices in principal cities.

Goetze Gasket & Packing Company, Inc., New Brunswick, New Jersey, has published a 56-page booklet covering Goetze gaskets. Gaskets for every purpose are taken up by chapters, of which there are 23, all illustrated. Tables giving numbers, sizes and prices are carried. The company will furnish a copy of the booklet upon request.

Goslin-Birmingham Manufacturing Company, Inc., Birmingham, Alabama, will send to interested persons upon request a copy of a recently issued bulletin, entitled "Contact Filteration of Petroleum Products." The bulletin features in a brief manner the advantages of the Vallez filter for contact filtration and shows the method of filteration in mechanical drawings.

The Hays Corporation, Michigan City, Indiana, announces a new 24-page catalog, RA-31, covering Hays combustion meters for carbon-dioxide, draft and flue gas temperature and Hays boiler panels. This new piece of literature is generously illustrated with half tones and line drawings to clearly show mounting dimensions, method of installation, operating principle and general appearance of the equipment. It will be forwarded upon request.

International Nickel Company, Inc., 67 Wall Street, New York City, has published the "Buyers' Guide to Nickel Alloy Steel Products," fall issue for 1930. It covers 16 pages, and presents a tabulation of sources of supply for the more commonly used forged, rolled, cast or drawn products made from Nickel steels and alloys. Materials listed are the standard Nickel alloy steels, the nickel-chromium corrosion and

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UNION HOISTS

THE UNION REVERSIBLE LOAD SPROCKET

on a solid alloy steel axle, is one of the most important of the FIFTEEN FEATURES which make Union Hoists more efficient, more dependable, and more economical. This Exclusive Feature—obtainable only in Union Hoists—is twice as durable as the usual hoist construction.

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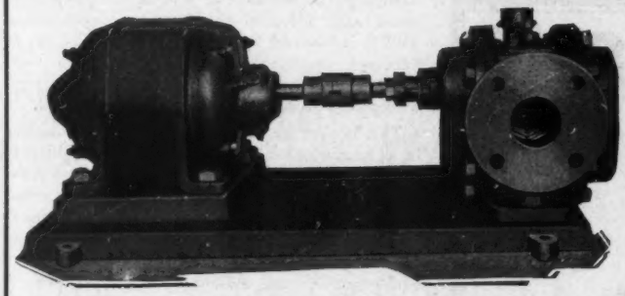
Branch Offices Carrying Stocks: NEW YORK, 26 Cortlandt St.; CINCINNATI, 332 Sycamore St.; CHICAGO, 27 S. Jefferson St.; SAN FRANCISCO, 661 Folsom St.; HOUSTON, I. Van Tassel, 1120 Union National Bank Building.



S&K GEAR PUMPS

are built to handle all oils—light or heavy, hot or cold.

Pressures up to 1500 lbs.

Special balancing feature insures long life.

Bulletin 17-A gives complete information.

Pump with gears

SCHUTTE KÖRTING

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Saving Through Salvage

OIL companies everywhere are discovering that reclamation of junked equipment provides a direct means of saving thousands of dollars.

Equipment and material that would otherwise be lost in the junk pile are now being restored to service by simple cleaning operations and repair work.

Let Oakite materials and methods put your salvage operations on a profitable basis because the Oakite way is safe, efficient and economical. Oil and muck covered valves, pipe fittings, rotary chains, corrugated sheet iron and equipment of every type are easily cleaned with a steaming hot Oakite bath. There is no fire hazard, no fumes.

Let us send you 20-page illustrated booklet giving more details of successful methods used in salvage work that have saved many concerns thousands of dollars. The booklet is free; or tell us your problems and give us an opportunity to submit suggestions for saving money for you in 1931.

Oakite Service Men, cleaning specialists, are located in the principal industrial centers of the U. S. and Canada

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Industrial Cleaning Materials and Methods

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EXPLOSION-PROOF MIXERS

Hy-Speed Portable Electric Mixers are the most efficient machines manufactured for blending, compounding, mixing or agitating all oils and liquid chemicals.

They clamp to any tank or vat in one minute and produce a more thorough, rapid mix . . . . more economically than by any other process. Capacities from five to 50,000 gallons.

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LUBRICATING OILS
LIME AND OIL
FULLER'S EARTH & OIL
ALL LIQUID CHEMICALS

ALSOP ENGINEERING COMPANY
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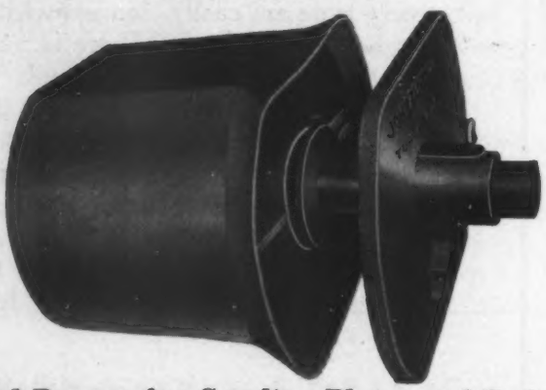
GAS BURNERS

Heat Without Flame



Special Burner for Gasoline Plants and Refineries

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Special Bi-Mix Burners for Drilling Boilers

Low Pressure Burners for Heating Plants

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Over Six Thousand John Zink Burners In Use

JOHN ZINK COMPANY

Oklahoma Natural Gas Building — Phone 4-9838
TULSA, OKLAHOMA

Items About Manufacturers

heat-resistant steels, and special ferro-nickel alloys, not including cast iron. This edition has been thoroughly revised and incorporates improvements such as footnotes concerning the size ranges and production limitations of the various concerns listed. International Nickel Company, Inc., will supply a copy of this guide upon request.

Krupp Nirosta Company, Inc., 2638 New York Central building, New York City, has announced that 51 steel producers have agreed to standardize specification symbols for chrome nickel steel produced within agreed analysis ranges. This co-operative action was taken following mutual concessions and agreement on the part of those companies producing chrome-nickel steels under license by Krupp Nirosta Company.

The adopted symbols with their ranges of agreed manufacturing analysis will be furnished upon request to the company at the New York address.

The Lummus Company, a new engineering and contracting firm having authorized capital stock of $10,000,000, has been organized to take over the business of the Walter E. Lummus Company of Boston. Superheater Company and Babcock & Wilcox Company hold substantial blocks of stock in the new firm.

The Lummus Company will engage in the design and manufacture of distillation and refining equipment for the alcohol, chemical, and petroleum industries, thus following the lines of activity pursued by the Walter E. Lummus Company, but operating on a larger scale.

The facilities and experience of Superheater Company and Babcock & Wilcox Company combined with those of the Lummus organization will, it is claimed by Walter E. Lummus, president of the new company, provide a well rounded and scientific organization able to cope with many problems in the industries served.

The Walter E. Lummus Company of Boston is an organization widely known in the distillation field for 30 days, having originated distillation processes and equipment of some note. The Superheater Company has extensive manufacturing plants at East Chicago and Sherbrooke, Quebec, and has built heat transfer equipment for the refining field, particularly in the form of tubular heaters. The Babcock & Wilcox Company is an old American organization, incorporated in 1881, and manufactures water tube steam boilers for sationary and marine service. The company also manufactures stokers, economizers, oil burners and other power plant auxiliaries. Babcock & Wilcox Company's plants are located at Bayonne, New Jersey; Barberton, Ohio; East Liverpool, Ohio; and Augusta, Georgia. A subsidiary company operates a tube mill at Beaver Falls, Pennsylvania.

Officers and directors of the new company are: Walter E. Lummus, president; Raymond R. Collins, vice-president; Raymond R. Collins, secretary, and Walter E. Lummus, treasurer.

Directors of the company are: Walter E. Lummus, Raymond R. Collins, George L. Bourne, F. A. Schaff, F. J. Faulks, C. W. Middleton and A. G. Pratt.

Michigan Valve & Foundry Company, Detroit, has published an illustrated folder covering the old Columbus valve which now has an improved design and which is made throughout with Meehanite, the new sorbitic cast iron. The company will furnish a copy of the folder upon request.

HAVING GASKET PROBLEMS?

LET US SOLVE THEM FOR YOU!

We make metal gaskets of any size or shape, plain or corrugated, with or without asbestos, also plain solid washers of copper, aluminum, monel metal or any material desired. Our Gasket Guide shows a very complete line of gaskets suitable for refinery work.

Copy sent upon request.

GOETZE

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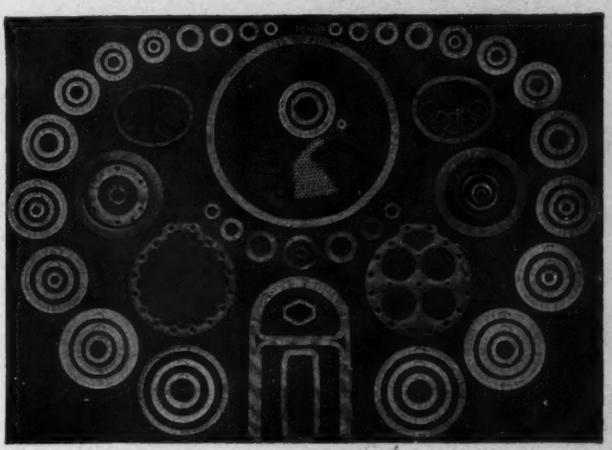
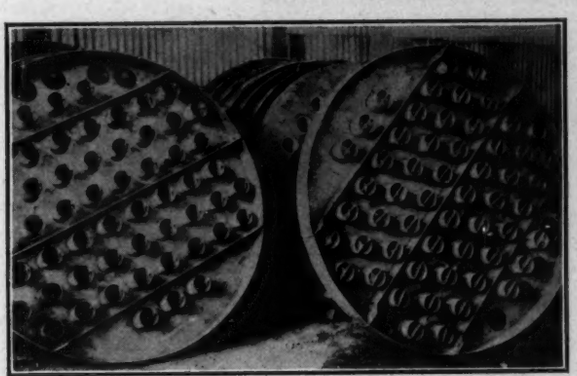
NEW BRUNSWICK, N. J.



A Few Types of Goetze Gaskets

What are your requirements in Stainless Steel Welds?



Bubble Cap Trays of Welded Stainless Steel

By years of experience in assembling by welding all grades of chrome and chrome nickel steel for special installations in refineries, chemical plants, mills, food industries and dye equipment, etc., we have developed sound, homogeneous, ductile, alloy welds of great strength.

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25 CHURCH STREET, NEW YORK CITY

733 MAYO BLDG., TULSA, OKLAHOMA

An airplane view of part of a refining plant at Ponca City, Oklahoma, showing our cooling tower. This tower is 60 feet high.

Cooling Water From 150 Degrees to 74 Degrees

THE 70 degree wet bulb is the July average for Oklahoma. Our problem was to design a cooling tower which would cool water going on the tower at temperatures from 125 degrees to 150 degrees to a point within 5 degrees of the wet-bulb, cooling over a range as much as 75 degrees.

The solution to the problem was a cooling tower 60 feet high with twenty decks. That cooling tower was installed almost four years ago, and the results to date have been entirely satisfactory. Records have been kept of the daily and often hourly performance of this tower, and true wet-bulbs have been taken with a sling psychrometer as well as stationary wet-bulb readings, so that the performance of the tower has been checked in every way against the cooling results it was designed to accomplish.

Not every refining plant has a water cooling problem like this. We cite this merely to show that our engineering department can handle difficult assignments when necessary. Ordinarily our Standard Type Cooling Towers will meet your requirements perfectly. They are described in our Bulletin 283-R, a copy of which will be sent on request.

THE COOLING TOWER COMPANY, INC.

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Representatives in Principal Cities

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REMOVAL OF WAX
FUELS AND COMBUSTION
PERCOLATING AND CONTACT FILTRATION

THE LESLIE LABORATORIES

TRAVER ROAD, ANN ARBOR, MICH.

Items About Manufacturers

Maintenance Engineering Corporation, Houston, announces the appointment of J. F. Huitt as sales engineer, effective December 1, 1930, to assist in the promotion of the more technical specialties for refineries, pipe lines and power plants, handled by the company. He was a student of Washington University where he studied mechanical engineering and power plant operation together with commrcial testing. He has for some time been connected with the Shell Petroleum Corporation, in the engineering department and later as assistant chief technologist.

Mine Safety Appliances Company, Pittsburgh, has just published the M-S-A first aid materials catalog Number FA-2 which will be of special interest to all users and buyers of first aid materials. It is a 36-page catalog, profusely illustrated and covers the complete line of first aid materials manufactured by this company for industrial and mining use. The completeness of the catalog is illustrated by the fact that it contains such items as poison ivy treatments, auto kits, hot pads, mercuro-compresses, bandages, etc. Copies will be furnished gratis to those interested in first aid work, upon application to the company.

Norma-Hoffman Bearings Corporation, Stamford, Connecticut, is mailing out an eight-page booklet describing and illustrating the "Norma Greaseal" felt-protected precision ball bearings of the close type, and will furnish copies to interested parties. Tabular information and mechanicel drawings offer much instructive help on making typical applications of bearings.

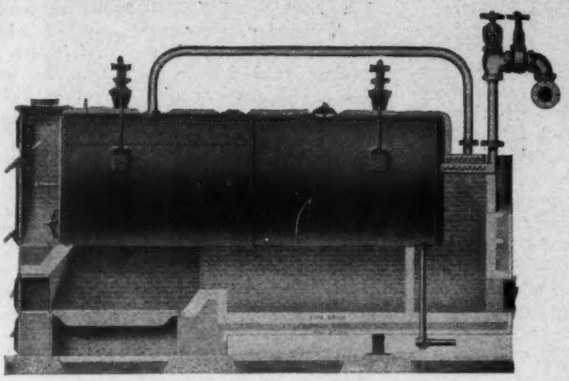
Neilan Company, Ltd., 641-651 Santa Fe Avenue, Los Angeles, announces a new bulletin describing the Neilan air operated pilot reducing steam regulator, No. 200. This regulator has an air operated pilot valve in place of the customary pilot operated by line steam pressure. A copy of the bulletin describing this valve will be furnished upon request.

H. A. Paine Company, Second National Bank Building, Houston, has been appointed as Texas distributor for Tri-Lok Company, Pittsburgh, selling open steel floor grating and treads, concrete armouring and radial grating. H. A. Paine Company, established 1898, is one of the oldest agencies handling refinery equipment in the South. In Texas the company has represented the Cochrane Corporation, Morris Machine Works and Erie City Iron Works since 1899, E. B. Badger & Sons Company, since 1918, M. H. Detrick Company, since 1920, De Laval Steam Turbine Company and De Laval Separator Company, since 1923, and Schutte & Koerting since 1928.

Refinery Supply Company, Tulsa, has issued its bulletin Number 15, containing a description of Ac-me and R. S. specialties in scientific and power plant equipment. Copies of the bulletin may be obtained from the company at 621 East Fourth Street, Tulsa.

George D. Roper Corporation, Rockford, Illinois, has issued Catalog 58, devoted to rotary pumps, hand and power, for all purposes. In this catalog the trade name "Trahern" is announced as being changed to "Roper."

A section is devoted to Roper hand rotary transfer pumps for drums and other oil containers, a section to Roper rotary pumps for general use, a section to Roper rotary pumps



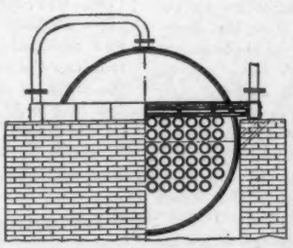
The Marley SUPERHEATER

for H. R. T. Boilers

Brings all the Advantages of Superheated Steam to the Small Steam Plant

WHERE greater steam capacity is essential and boilers already are overloaded —where fuel consumption is too high— where wet steam interferes with efficient operation — where lubricating difficulties are encountered or rear arches give trouble —A Marley Steam Superheater can be used to advantage.

Marley Superheaters are low in first cost, easy to install and can be applied to boilers using any kind of fuel. They are easily drained, easy to inspect and clean and have long life because they are installed outside high temperature areas.



Installation view of Marley Superheater for H. R. T. boilers. Note how it acts as the rear arch.

Write today for full information and let us show you just how the Marley Superheater can be used profitably in your plant.

THE MARLEY CO.

1737 Walnut, Kansas City, Mo.

Representatives in Principal Cities

HYTEMPITE

Plus The Quigley Gun

Will repair your furnace walls, arches and baffles with speed and economy.

Applying Hytempite Mixture

A prominent plant superintendent writes: *"We are very well pleased with the Refractory Gun. We find that it is certainly saving us money on the maintenance of our furnaces and of course we get a much better job by applying Hytempite with this device. We expect to start work on one of our new baffles within the next day or two."*

All firebrick settings develop weak spots from time to time. A well applied patch with the proper materials will often save an expensive job of reconstruction and a lengthy shut-down.

HYTEMPITE forms a lasting bond when mixed with crushed firebrick or Ganisand. A patch made of this mixture becomes a part of the structure.

THE QUIGLEY REFRACTORY GUN projects this plastic mixture of HYTEMPITE and crushed firebrick or Ganisand at high velocity, directly to the place to be patched and the mixture *sticks.*

Patches are made and surfacing applied rapidly and without shutting down the furnace.

Baffles, too, are installed quickly and economically with the QUIGLEY GUN and HYTEMPITE mixture.

The Gun is portable, with a long hose attachment.

Easily operated and easily controlled — the QUIGLEY GUN is an economy in most plants containing firebrick settings.

Repairing Baffles with Quigley Refractory Gun.

Send for Booklet RG 138, and the name of our local distributor.

QUIGLEY COMPANY INC.

INDUSTRIAL SPECIALTIES

56 West 45th Street, New York

Distributors with Stock and Service in every Industrial Center

Talking Points are Talking Points

But—

When hundreds of firms, on *Job* after *Job*, YEAR after YEAR—continue to use ANY one product—

It Must Have Advantages of Importance to You, Too.

Arrowhead Flooring, Grating and Treads

ARROWHEAD IRON WORKS, Inc.

431 WEST FIFTH

KANSAS CITY, MISSOURI

Resolve that in 1931

you will equip all of your Oil Stills with

CAMPBELL Steam Flow Controllers

Write for complete information concerning the economies effected by controlling, indicating, and recording—all simultaneously. Steam flow control is our specialty.

The Campbell Engineering Co.
282 South St., Newark, N. J.

Manufacturers of the TAR BABY BURNER, to handle Fuel Oils, Water Gas Tar, Acid Sludge and Residue Fuels.

Without obligating us in any way, please send information on ( ) the Watermelon Type of Steam Control for Oil Stills; ( ) the Pumpkin Seed Type, ( ) the Tar Baby Oil Burner for burning residue and other fuels.

Name .....

Firm .....

Address .....

Items About Manufacturers

for cooling and lubricating purposes, a section to Roper pumps for hydraulic mechanisms, a section to rotary pumps for truck tank application and a section to steam jacketed rotary pumps for pumping heavy liquids.

Another section is devoted to the standard construction of Roper rotary pumps and also useful information and engineering tables. This catalog is 102 pages in length and printed in two colors. It is replete with tables and charts valuable to engineers. It is profusely illustrated with both photographs and mechanical drawings. A copy is available upon request to the manufacturers.

Spencer Kellogg and Sons Sales Corporation, Buffalo, has issued a little pocket booklet showing a graphic picture "Our Industrial Family Tree," which shows the logical handling of orders on vegetable oils.

Schutte & Koerting Company, Philadelphia, has issued Bulletin 9-S, covering the company's line of strainers for oil, steam, water, etc., and will furnish a copy to interested persons upon request to the general office, 12th and Thompson Streets, Philadelphia.

Strong, Carlisle & Hammond Company, 1392 West Third Street, Cleveland, Ohio, has published Catalog 34, a 56-page layout covering Strong steam specialties. The complete line of Strong products is completely described and illustrated, and the catalog is available for the asking.

Turbo-Mixer Corporation, New York City, has appointed National Supply Corporation, of that city to represent them in England, Roumania and the Argentine for all products of its manufacture for the petroleum industry.

Western Engineering Company, San Francisco, will represent Turbo-Mixer Corporation in the section of California north of the Tehachapi Mountains for all products of its manufacture.

Turbo-Mixer Corporation, 250 East 43rd Street, New York City, announces the publication of a 12-page bulletin devoted to giving the advantages of the Turbo Mixer from the standpoint of construction, wide range of applications, drives, and unique principles. A copy will be mailed upon request to the above address.

Taber Pump Company, 288 Elm Street, Buffalo, has issued a bulletin on the Type "L" single suction centrifugal pumps, in capacities ranging from 15 to 2000 g.p.m. The Taber house pump for booster service, Type O.H.S., horizontally split, two stage opposed impellers is covered in another bulletin, the Taber Type "R" rotary pumps for handling various liquids is covered in Bulletin R-929, while the Taber double suction centrifugal pumps built in capacities up to and including 1500 g.p.m. is covered in a fourth bulletin.

C. H. Wheeler Manufacturing Company, Lehigh and Sedgley Avenues, Philadelphia, announces the appointment of P. A. Thompson to take charge of the heat transfer equipment division with headquarters in Philadelphia. This division, as in the past, will design and manufacture exchangers, condensers and coolers for oil refineries and industrial uses. F. A. Faville has also joined the company as manager of the Chicago office, located at 1122 Marquette Building, Dearborn and Adams Streets.

Worthington Pump & Machinery Corporation, Harrison, New Jersey, announces the publication of a 44-page bulletin, D-423-B1, superseding D-704, covering power pumps, vertical triplex. It is cut for insertion in loose-leaf folders, and will be furnished upon request to the above office or to the executive offices at 2 Park Avenue, New York City. The publication opens with showing parts of these power pumps, and takes the reader through to installations on the job at the close of the bulletin.

Worthington Pump & Machinery Corporation, Harrison, New Jersey, announces the publication of a 32-page bulletin covering Worthington deep well pumps, including "Axiflo," "Hiflo" and "Coniflo." Photographs of these pumps working and also mechanical drawings showing every working part, serve to thoroughly illustrate this line of pumps, both for deep well pumping and in deep sea terminal loading. The bulletin is cut for insertion in loose-leaf filing. Copies are available by writing the general office, shown above, or to the executive offices at 2 Park Avenue, New York City.

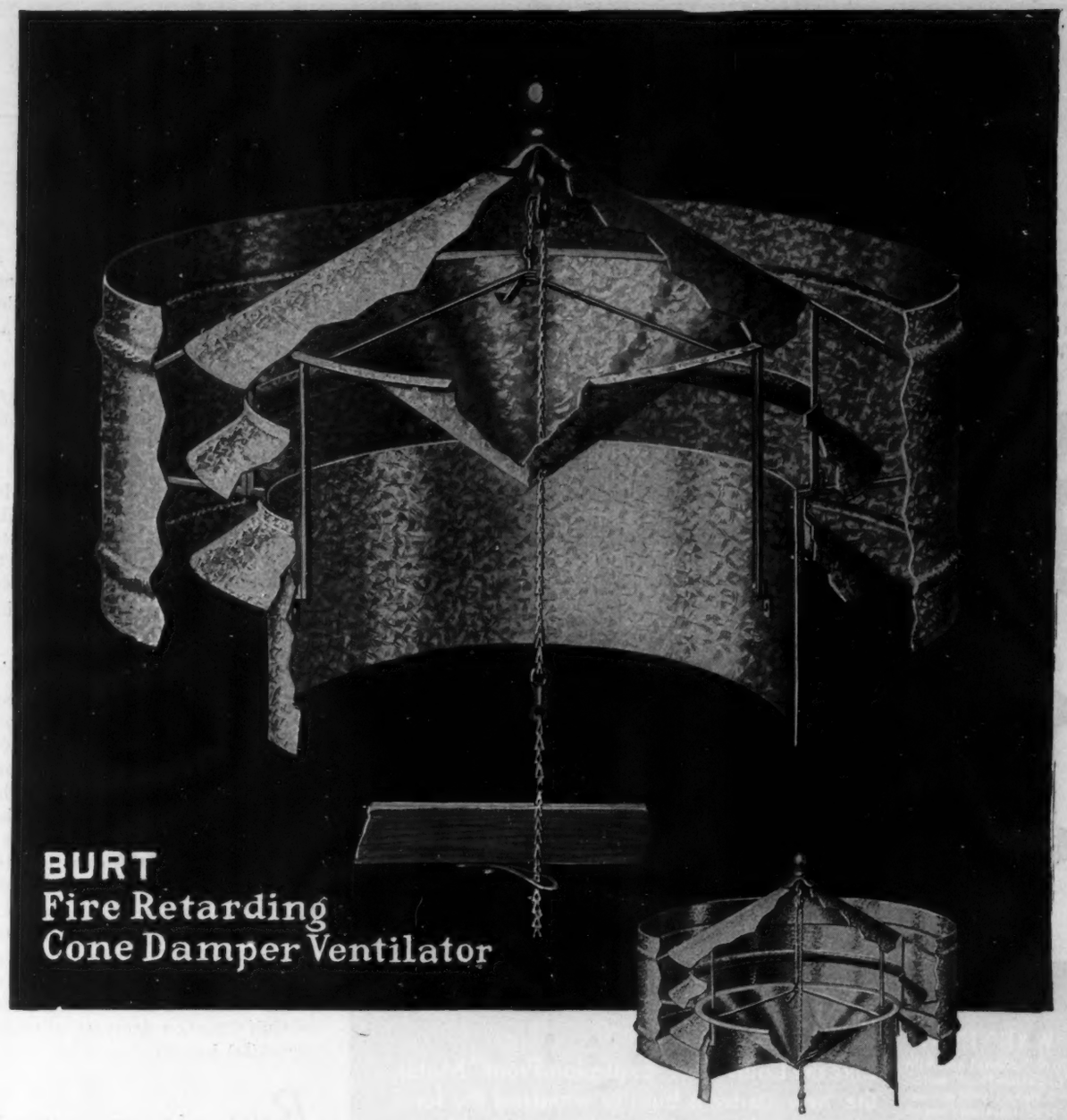
H. A. KASSELBAUM

Rapid Fire Prevention Company, Ltd., manufacturers of rapid water-fog operated fire prevention equipment, has appointed Harry A. Kasselbaum sales manager. Kasselbaum, who has been connected with the oil industry since 1910, was formerly sales manager for Elliott Core Drilling Company, and previous to that was assistant to the president of General Petroleum Corporation. He has been active in the work of the California "wildcat" organization and with the American Petroleum Institute on the Pacific Coast.

Offices of the company rae located at 1520 East Slauson Avenue, Los Angeles.

Announcement has been made by the manager of the Oil Equipment and Engineering Exposition, Los Angeles, that free space will be given to exhibiting models and drawings of new devices for use in the oil industry at the Second Annual Exposition being held from March 16 to 22, 1931. This free space is given in the interest of getting together the manufacturer interested in obtaining inventions and the inventor desirous of placing a new invention before the manufacturer.

Electrically Driven Centrifuges
Hand Centrifuges
WRITE
WILLIAMS, BROWN & EARLE, Inc.
Manufacturers of Laboratory Apparatus
918 Chestnut St. Philadelphia, Pa.



for SAFE VENTILATION

BURT
EXHAUST HEADS

Increase boiler economy, reduce noise and save roofs. Made in two types and all sizes.

In addition to its high exhaustive power, the Burt Cone Damper Ventilator offers the advantage of fire protection by means of the patented fuse link which automatically closes the damper at dangerous temperatures. The extra wide wind band, scientifically designed Cone Damper and unobstructed air passage combine to give it the large capacity that assures your building of effective ventilation. This ventilator is but one of the complete line of Burt Ventilators—there is a size and type for every condition—write for our catalog today.

The BURT MFG. Co.

Ventilators-Oil Filters-Exhaust Heads

E. South St. AKRON, OHIO

BURT
OIL FILTERS

More than 300,000 in service cutting lubricating costs and saving machinery. Capacities 5 gallons per day and up.

THE MONTH IN REVIEW

In the following columns will be found a brief digest of happenings of interests to refiners, with even reference to a rumor or two!

REFINERY runs to stills during December aggregated 71,581,000 barrels, a daily average of 2,309,000 barrels. This compares with a total during November of 70,310,000 barrels, a daily average of 2,344,000 barrels. Total runs for 1930 amounted to 927,447,000 barrels, representing a decline under 1929 of 60,261,000 barrels. A further decline in still runs was recorded during the week ending January 31, when the daily average amounted to about 2,284,000 barrels. This rate is considered normal for the month of February and should be maintained until March 1.

Now a *Companion* for the "Explosion-Proof" Motor

... the Louis Allis *air-break* "Explosion-Proof" Motor Starter

The pioneer builder of "explosion-proof" electrical apparatus now announces the first AIR-BREAK "EXPLOSION-PROOF" MOTOR STARTER.

WARNING!

Do not confuse Louis Allis "Explosion-Proof" motors and starters with non-approved so-called "vapor-proof" apparatus. Real "Explosion-Proof" motors and starters must pass severe explosion tests to be approved by Underwriters' Laboratories for use in Class 1 explosive atmospheres.

Like the Louis Allis "Explosion-Proof" Motor, the new starter is built to withstand the force of any explosion that might occur inside the starter, and to prevent the escape of flame.

Tested and approved by Underwriters' Laboratories for Class 1 locations . . . inexpensive, simple, safe and easy to install wherever gasoline, naphtha, alcohol, benzol, and other equally hazardous liquids are made, used, or handled.

Write for complete information

"EXPLOSION-PROOF" *Electric* MOTORS

THE LOUIS ALLIS COMPANY
MILWAUKEE, WIS.

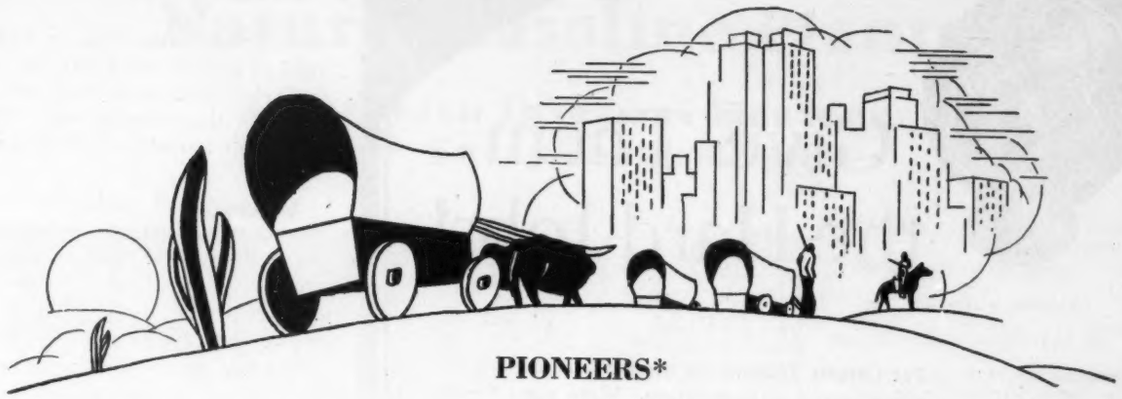
SALES OFFICES: Tulsa, Houston, St. Louis, Chicago, Detroit, Cleveland, Pittsburgh, New York, Philadelphia, Boston, Buffalo, Los Angeles, San Francisco . . . and other principal cities.

WELL completions in the United States during 1930 showed a decline under 1929 of 3615, while initial oil production from producing wells completed increased over 1929 to the extent of 4,000,000 barrels. Total well completions during 1930 amounted to 19,848, against 23,463 in 1929. Initial oil production aggregated 10,443,863 barrels in 1930, against 6,404,145 barrels in 1929.

CRUDE oil production of the United States for 1930 is estimated at 909,627,733 barrels, against 1,002,097,243 barrels in 1929, a decrease of about 92,000,000 barrels. Declines in production were recorded by Texas, Arkansas, California and Oklahoma. Other areas reported gains. California reported the largest decline in crude production; the total for 1930 recording a decrease under 1929 of more than 60,000,000 barrels. Oklahoma's crude production declined during 1930 to the extent of 35,000,000 barrels, while Texas (outside of Gulf Coast) a decrease of more than 18,000,000 barrels.

RUSK and Gregg Counties, Texas, newest oil producing territory, promises not only to become one of the largest the state has ever witnessed, but will yield sweet crude, with a relatively high gasoline recovery by skimming plant procedure. With this prolific condition existing the district will see the establishment of a large number of skimming plants refining the cheap crude with the building of plants rivaling a like condition in West Texas, where sour crude attracted about 20 refiners two or three years ago. At this time two plants are building and several are proposed. Through pipe lines and tank car the crude will find its way to the refining districts of Shreveport, Dallas, Houston, and Middle-Western refining centers.

Rusk County crude is dark green in color, low in sulphur, runs 36 to 40 A. P. I. gravity, and by Hempel distillation yields 33 to 37 per cent sweet gasoline,



PIONEERS*

EFFICIENCY in your operations depends upon the purity and uniformity of composition of the raw materials or reagents you use, and *the way in which you handle them.*

CHEMICAL CONTROL METHODS, which insure the excellence of your products, are also responsible for the extreme purity and unusual uniformity of *PIONEER OYSTER-SHELL LIME* — the most efficient chemical lime.

Pioneer Lime is a Finished Product

THE HADEN LIME COMPANY
MFRS. OF PIONEER OYSTER SHELL LIME
1720 SHEPHERD STREET
HOUSTON-TEXAS

*PIONEER—One who goes before and opens the way.—*Worcester's Dictionary.*

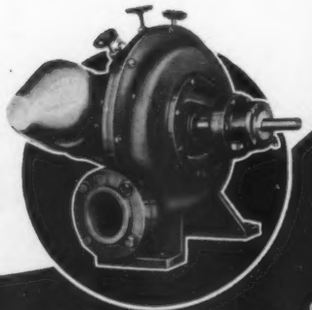
Give Them the Hard Jobs!

Put Coppus Turbines on the hardest jobs . . . . where service is most severe. Make them "prove their mettle"! They'll come across every time. On draft fans, recirculating fans, centrifugal pumps . . . . wherever steam drive can be used Coppus Turbines will adequately meet the demands for all heating and process work.

Turbine wheel is of the two row velocity stage impulse type . . . buckets are of non-corrosive and non-erosive metal and are cast into the wheel by a patented process. Valve and governor are of unique design and insure easy speed control . . . . Exhaust steam is free from oil and can be readily used for process work.

Coppus Engineering Corporation
360 Park Avenue
Worcester, Mass.

Our Bulletin 120-2 prepared especially for Oil and Gas Manufacturers tells about Coppus Turbines in detail. We will gladly send you a copy on request.



KERLOW GRATING

FLOORS, STAIRS *and* LADDERS

KERLOW STEEL FLOORING COMPANY
220-22 CULVER AVE., JERSEY CITY, NEW JERSEY

The Month in Review

10 to 15 per cent kerosene, and a large yield of gas oil, which like the remaining fuel oil residue, lends itself well to processing in the cracking unit. The crude has a pour test of about 25°F. and is wax bearing.

An analysis of crude from the Gregg County well, Moncrief & Farrell's Lathrop 1, shows 40.1° A. P. I. gravity, olive green color, good odor, 2.2 per cent b.s. and w. (wax), no water, 0.218 per cent sulphur, and a pour point below 45°F.

Gasoline from this crude, with the Hempel column was 38 per cent with a gravity of 57.5, I. B. P. 119, end point 435°F. plus 30 color, corrosion was negative, nearly sweet to the doctor test, good odor, and 0.02 per cent sulphur. This type of analysis indicates 42.6 per cent gas oil (no kerosene cut was taken) with 32.1° A. P. I. gravity, and pour point of 80°F. Residuum was 17.6 per cent of 14.8° A. P. I. gravity, a flash of 595 and fire of 675°F.

IMPORTS of gasoline during 1930 reached a total of 16,927,000 barrels, compared with 8,834,000 barrels in 1929. This was an increase of more than 8,000,000 barrels, or nearly double the quantity imported during the preceding year. Under existing conditions, it will be necessary to prevent the continuation of such a gain in imports this year. A reasonable quantity of imported gasoline for 1931 would contemplate a total of not more than 13,000,000 barrels, and it would be well for the industry to consider that quantity in this year's supply situation.

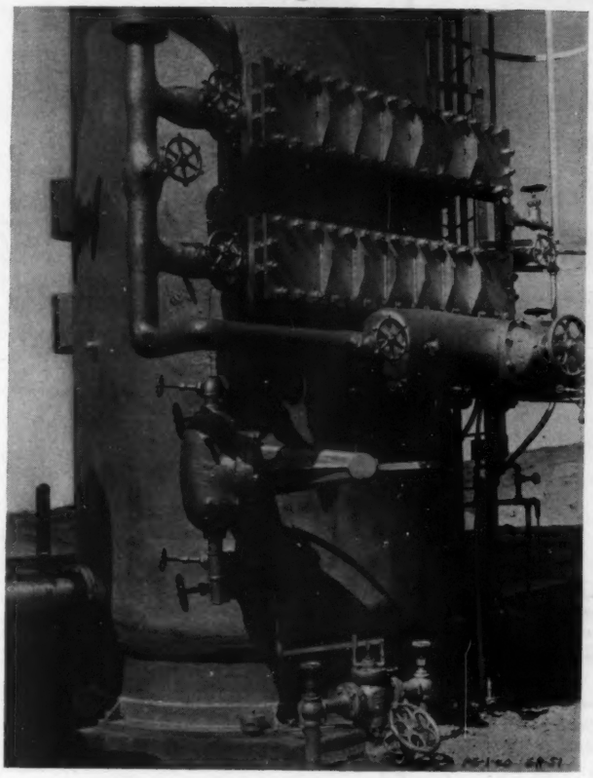
EXPORTS of refined oils during 1930 showed a decline of nearly 4,000,000 barrels. The total for 1930 was 132,960,000 barrels, against 136,719,000 barrels in 1929. This indicates the degree of competition being injected into the industry's foreign market situation. It also points to the possibility that America's foreign oil trade is dwindling to an alarming degree. Foreign refinery expansion is forging ahead rapidly and foreshadows the possibility that United States exports may ultimately reach the vanishing point.

ROYAL Dutch-Shell, Anglo-Persian Oil Company, Gulf Oil Corporation, Atlantic Refining Company, Standard Oil Company of New York and Standard Oil Company of New Jersey, and Compagnia Francaise des Petroles,

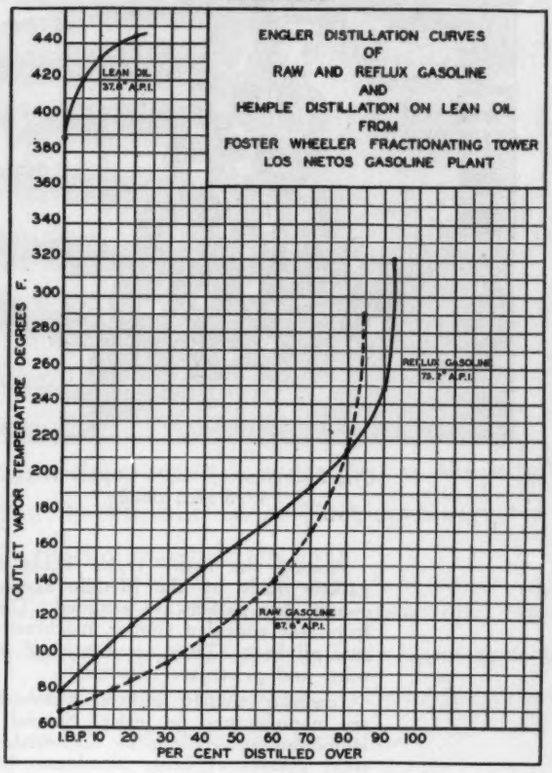
Effective Stripping of Lean Oil in Natural Gasoline Plants

Stills with Internal Heaters Provide Exceptional Results—

Design



Results



The accompanying photograph shows a Foster Wheeler 72-in. still with 7 fractionating and 7 stripping trays at the Los Nietos plant. The two lower stripping trays are equipped with Foster Wheeler straight tube heaters. The tubes may be inspected without removing the pipe connections.

Due to superheating the live steam, the exhaust from the turbine which is put into the still for stripping is moderately superheated. This has the advantage of reducing the tendency for the oil and steam to form emulsions within the column.

The curves show Engler distillation of raw and reflux gasoline and Hemple distillation on lean oil from a Foster Wheeler still at the Los Nietos gasoline plant. The 94 deg. F. gap between the initial boiling point of lean oil and end point of raw gasoline shows complete stripping. The samples of oil and gasoline were taken from the coolers through a second test cooler at a temperature of 34 deg. F. to prevent loss of light fractions. The lean oil distillation was made with 500 c.c. oil in Hemple Column.

OPERATING CONDITIONS ON 72" STILL

Lean oil circulation	10,800 gals. per hr.
Raw gasoline	1,618 gals. per hr.
Fixed gas in oil	40,700 cu. ft. per hr.
Stripping steam	3,800 lbs. per hr.
Reflux gasoline	2,880 gals. per hr.

FOSTER WHEELER CORPORATION

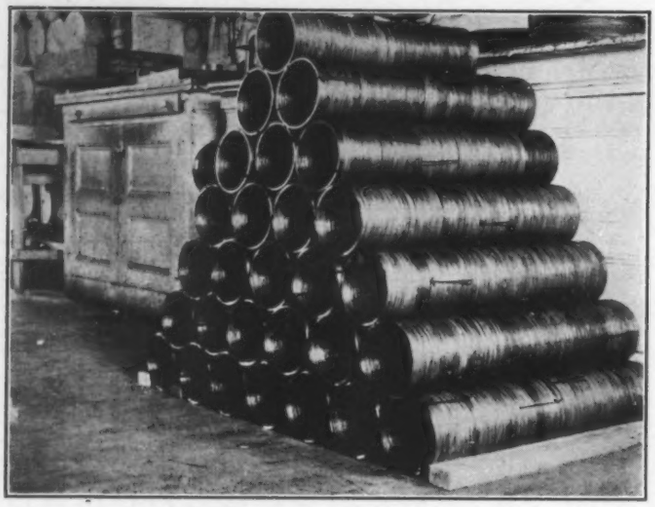
165 Broadway, New York, N. Y.

Branches in Principal Oil Centers

Foreign Associates: Foster Wheeler Limited, London, England
Societe Anonyme Foster Wheeler, Paris, France
Foster Wheeler Limited, Toronto—Montreal, Canada

FOSTER WHEELER

METALLO
COPPER RINGS



One Shipment of 4,704 Copper Rings, 3/16 inch thick.

Among the many types, kinds and sizes of gaskets made by the Metallo Gasket Company, copper ring gaskets are included. These are made from soft annealed copper, machined smooth and true all over. They are furnished in all desired sizes, and prices are reasonable.

Irregular shaped gaskets, metal-asbestos filled, are manufactured on order. Special shaped solid aluminum gaskets can be furnished. Washers or solid gaskets of lead, aluminum, brass, copper, steel, Armco Iron or other material furnished in all sizes.

Whatever your gasket needs, take advantage of the Metallo reputation for high quality, prompt service and moderate prices.

Write for catalog and prices.

METALLO GASKET CO.
NEW BRUNSWICK—NEW JERSEY

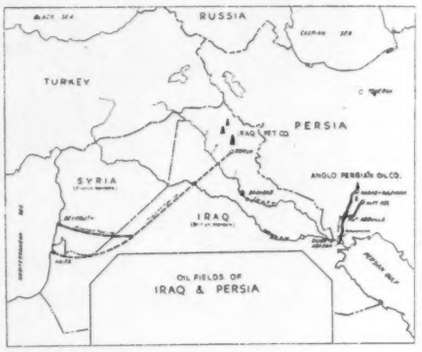
Designed for Oil, Gas and Pulverized Fuel Firing

BURNERS
PEABODY

Peabody Engineering Corporation
46 EAST 41ST STREET, NEW YORK

The Month in Review

which interests make up Iraq Petroleum Company, and operate the Baba Gurgur, and perhaps other structures in the northern part of the kingdom of Iraq, (Mesopotamian desert, bounded by Persia and Turkey), propose a 600-mile pipe line from Kirkuk to Beyrouth or Haifa, on the Mediterranean Sea, to transport about 100,000 barrels of Iraq



crude per day. With the completion of this line there looms the possibility of four more foreign refineries. The French, it is conjectured, will need a plant to refine oil at Marsailles, and perhaps another on the Western Coast. The American interests whose share of the oil is about 20,000 barrels per day very likely will erect a co-operative refinery, or possibly two, to handle their portion of the oil, and the Royal-Dutch interests, or the Anglo-Persian Oil Company must either enlarge their present refining facilities to care for their oil or erect additional plants at strategic points.

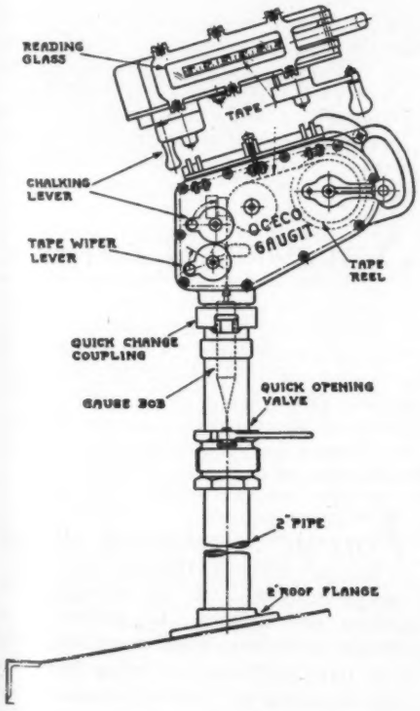
ACCORDING to late reports Cities Service Company has acquired control of Warner-Quinlan Company through purchase of common stock. Although officials of each company had been unwilling to make any comments on February 4, confirmation of the deal is expected soon. Warner-Quinlan Company has been one of the important refiners and marketers operating in the East Coast territory for the past several years. The company has a refinery at Warners, New Jersey, with a capacity rating of 18,000 barrels per day, equipped with Dubbs cracking units.

ARKANSAS Fuel Oil Company (Cities Service) has announced that it will build an eight-inch pipe line from the new producing area in Gregg County, Texas, to Shreveport, thus assuring the Shreveport refining district with a supply of East Texas crude. The line will be 70 miles in length, and is being constructed primarily to deliver crude to the refinery of Louisiana Oil Refining Corporation, also a Cities Service subsidiary.

Announcing the OCECO GAUGIT

for Safety and Economy

Gauges without releasing pressure or gassing the gauger.



Simple, strong construction. No delicate parts to get out of order.

THIS gas-tight device is made fast to the nipple as shown in the illustration. A quick-opening valve then permits the bob to enter the tank.

The reading is taken through the glass top. The tape is automatically chalked and wiped. At no time is the tank opened to the atmosphere, yet gauging operation is the same as with the usual hand tape.

A permanent "Gaugit" can be installed on each tank, if desired, or this portable gaugit is light enough (all aluminum) to be carried from tank to tank by the gauger.

Suitable for sampling also, since a thief can be readily substituted for the bob.

Write for quotations today.

THE OIL CONSERVATION ENGINEERING COMPANY

877 Addison Road, Cleveland, Ohio

Engineering and Sales Service:

90 West St., New York City — Box 552, Beaumont, Texas

WESTCOTT & GREIS, INC.,

405-9 Beacon Life Bldg., Tulsa, Okla. — 2013 Santa Fe Ave., Los Angeles, Cal.

OCECO

LIMITLESS POSSIBILITIES! The STAINLESS STEELS With I. W. A. STAINLESS WELDING

We weld *any* of the high-chrome — high-nickel alloys—without preference or prejudice.

We specialize on just that — with methods and man power unconcerned with handling common - place materials.

IN EVERY WAY EQUAL TO THE METAL OF THE PLATE ITSELF

One test of a 4-mile order of 6-inch "18-8 Alloy" Pipe, made under customer's inspection to demonstrate the mechanical perfection of I.W.A. welding. Never a flaw!

WHO but the specialist is qualified for the responsibility of welding the stainless steels? Who but this Company has the specialized experience? In 1930, as in 1925-6-7-8-9, our ouput of weld-fabricated stainless steels exceeded that of all other commercial fabrications combined. Experience? Capability? . . . . . Indeed, yes!

Let our engineers cooperate in planning for the greatest ultimate advantage and economy.

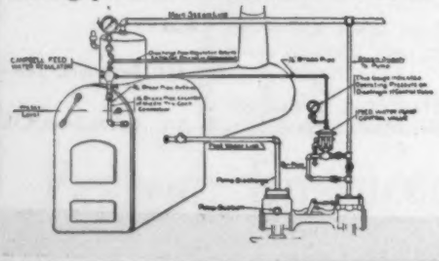
INDUSTRIAL WELDED ALLOYS, INC.

8 Lister Avenue Newark, New Jersey

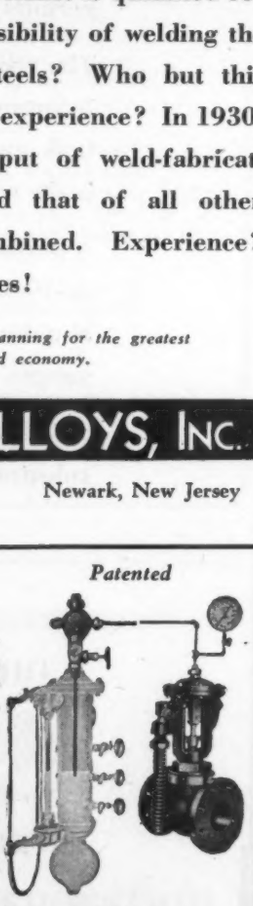
How to Regulate Refinery Boiler Feed Water

Patented

The sketch below shows a typical hook-up. Write for complete data. The CAMPBELL is priced at a figure within reach of the smallest refinery as well as the largest. No moving parts. No thermostats. No floats. No generators.



Simple.
Rugged.
Dependable.
Easily installed.
No servicing required.



ATLAS VALVE CO.,
275 South Street, Newark, N. J.

The Month in Review

This plan has a capacity of 25,000 barrels. Others who may be benefitted are Crystal Oil Refining Corporation, 10,000 barrels capacity; Shreveport-El Dorado Pipe Line Company, 10,000 barrels capacity; Stanolind Oil & Gas Company (formerly Dixie Oil Company), 3000 barrels capacity. It is reported that the pipe line rate to Shreveport will be about 15 cents per barrel.

SHELL Petroleum Corporation, St. Louis; Shell Eastern Oil Company, New York, and Shell Oil Company, San Francisco, shortly will offer lubricating oil manufactured from Pennsylvania crude oil. Arrangements have been made with a number of Pennsylvania refiners to supply the needs of the Shell companies in this country. The new lubricant will be put on sale at the same time that Ethyl gasoline becomes available at the Shell stations.

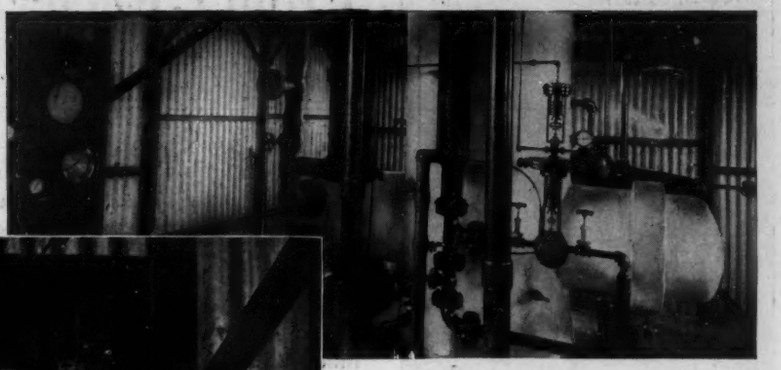
STANDARD Oil Company of Ohio has acquired Refiners Oil Company, Dayton, and a substantial interest in the Ajax Corporation, which owns the new Ajax pipe line extending from Glenn Pool, Oklahoma, to Wood River, Illinois. Standard Oil Company of New Jersey and Pure Oil Company are other owners of the Ajax Pipe Line Company.

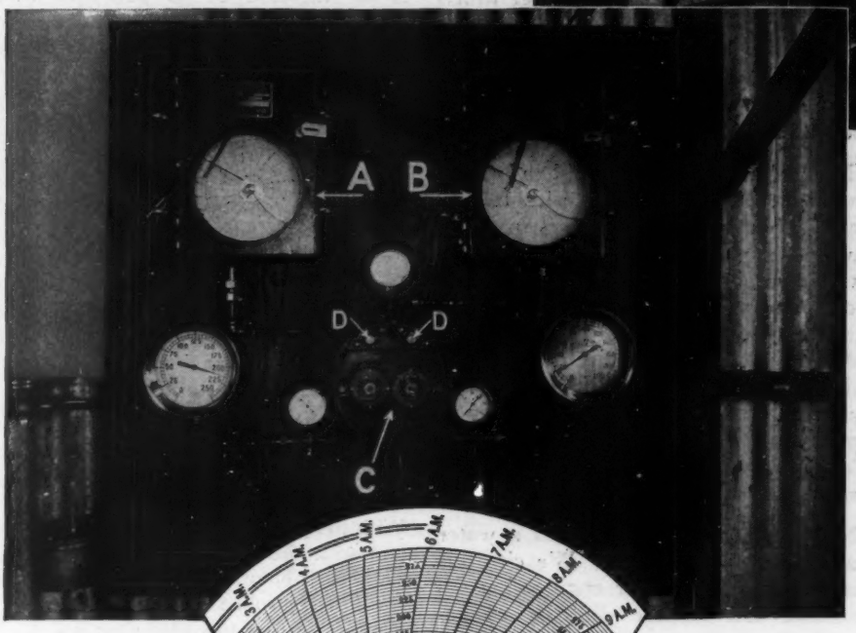
STANDARD Oil Company of New York is considering construction of a gasoline pipe line from its refinery at Providence, Rhode Island, to Springfield, Massachusetts. A report is being prepared on the project by the company's engineering department. Preliminary plans call for a four or six-inch line. As yet no right of way has been secured or survey made.

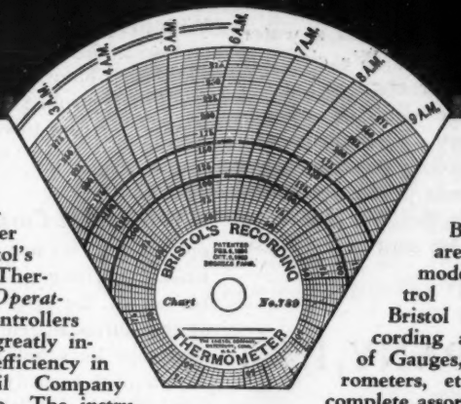
VOLUME of lubricating oil used by industry is greater than that used in automobiles, both from the standpoint of gallons and dollars. In gallons, it is double, in dollars, about one-third more, with total purchases exceeding $300,000,000, according to a survey conducted by McGraw Hill Publishing Company. The survey revealed also that 33 oil companies are securing 81 per cent of the industrial business. There is little selective selling. While only 16 per cent of the plants purchase 72 per cent of the total lubricants consumed, oil companies make little effort to concentrate on these plants, but work as hard selling 40 per cent of the plants whose combined purchases represent but four per cent of the total consumption. Industrial lubricants, offering

ANOTHER PRODUCTION PROBLEM

SOLVED THROUGH USE OF BRISTOL'S INSTRUMENT EQUIPMENT . . . . . .







A—Model 40 Recording Pressure Gauge, 8", 24-Hour Chart, No. 2172; range 0 to 250 lbs., for recording stabilizer pressures.

B—Model 340 Recording Thermometer, two pens; 8" 24-Hour Chart, No. 789, range 40 to 300°F.; installed to record Stabilizer top and bottom temperatures.

C—Double Service Distance Type Air Operated temperature Controller; series No. 152, reverse and direct acting, scales 150 to 250° F., and 75 to 175°F., installed to automatically maintain correct Stabilizer Temperatures.

DD—Controller Air Valve; which, owing to simplicity of design, is conveniently accessible for cleaning, inspection or replacement. To remove unscrew and lift out valve with spring attached. The valve seat is then exposed, almost flush with case front. To replace, simply screw into place again—no further attention or adjustment is required.

CONTINUOUS control of stabilizer operation under direction of Bristol's Recording Gauges, Thermometers and *Air Operated* Temperature Controllers has brought about greatly increased production efficiency in the Oklahoma Oil Company Plant pictured above. The instruments mentioned operate to automatically record and control stabilizer pressures and temperatures . . . assuring constant adherence to pre-determined operating schedules. Evidence of the close control obtained is seen in the thermometer chart with record reproduced here . . . one record line showing top temperature and the other the bottom temperature cycle over a period of 24 hours.

This is a typical example of how Bristol's Instruments are being adapted to modern production control requirements. The Bristol line offers both recording and indicating types of Gauges, Thermometers, Pyrometers, etc., together with a complete assortment of electrical or air operated Temperature or Pressure Controllers and Controller Valves.

Detailed information regarding any type of instrument in which you are interested will be sent immediately on request. Write direct to The BRISTOL COMPANY, WATERBURY, CONN., or to Bristol's Branch Office nearest you.

FIELD ENGINEERING SERVICE

As an aid in adapting Bristol's Instruments to the particular requirements of your plant, The Bristol Company maintains a very complete Field Engineering Service. The men comprising this Engineering group are technically trained, and thoroughly schooled in the construction, design and application of Bristol instruments. They are prepared to consult with your engineers; to assist in any needed survey work, and aid in every possible way the development of instrument possibilities. This service is offered entirely free of obligation.

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Instruments *for* Indicating Recording Controlling

An airplane view of part of a refining plant at Ponca City, Oklahoma, showing our cooling tower. This tower is 60 feet high.

Cooling Water From 150 Degrees to 74 Degrees

THE 70 degree wet bulb is the July average for Oklahoma. Our problem was to design a cooling tower which would cool water going on the tower at temperatures from 125 degrees to 150 degrees to a point within 5 degrees of the wet-bulb, cooling over a range as much as 75 degrees.

The solution to the problem was a cooling tower 60 feet high with twenty decks. That cooling tower was installed almost four years ago, and the results to date have been entirely satisfactory. Records have been kept of the daily and often hourly performance of this tower, and true wet-bulbs have been taken with a sling psychrometer as well as stationary wet-bulb readings, so that the performance of the tower has been checked in every way against the cooling results it was designed to accomplish.

Not every refining plant has a water cooling problem like this. We cite this merely to show that our engineering department can handle difficult assignments when necessary. Ordinarily our Standard Type Cooling Towers will meet your requirements perfectly. They are described in our Bulletin 283-R, a copy of which will be sent on request.

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The Month in Review

a demand twice that of the automobile, provide a worthwhile market for the lubricating oil manufacturers of the refining industry.

SALES of Ethyl gasoline during 1930, nearly 2,000,000,000 gallons, which is an increase of 48 per cent over 1929, according to a recent announcement by Ethyl Gasoline Corporation. Ninety-seven refiners now hold Ethyl licenses. Thirty-three of these were added during 1930. These licensees now constitute almost all of the major refiners of this country. Refiners listed during 1930 include The Texas Company, Skelly Oil Company, Standard Oil Company of Pennsylvania, Barnsdall Corporation, Magnolia Petroleum Company, and Pure Oil Company, and others. Since the first of this year licenses have been given to the Shell Oil Companies operating in this country, and Gulf Refining Company.

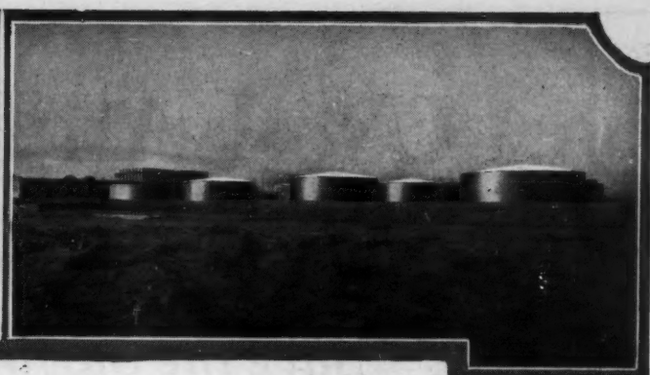
The company states that Ethyl gasoline is now sold through 200,000 retail outlets in 40,000 cities and towns in every state in this country and provinces in Canada. With the popularity of the fuel increasing and with the addition of the latest national distributors of gasoline, the demand for Ethyl gasoline will no doubt show a marked increase this year over last.

SHELL Oil Corporation has started operation of its new complete refinery at Budapest, Hungary, which is reported to be one of the largest and most modern of the European refineries. The plant has four pipe lines linking it with tidewater. The annual capacity is reported at 600,000 barrels annually. A chemical plant is included with the refinery.

ASSOCIATED Oil Company has begun construction of a gasoline line from the mid-state oil fields of California to Pacific Coast seaboard. The project involves 60 miles of six-inch 16.234-pound grade "A" seamless steel line pipe.

This line starts in the north Belridge oil fields, thence via lost Hills and Kettleman Hills to Coalinga, where it connects with an existing six-inch line which traverses the mountain and valley regions between Coalinga and Monterey Harber.

The latter portion of this job calls for complete reconditioning of approximately 90 miles of pipe which, for the past 28 years, has been used for transportation of crude oil from the Coalinga fields to



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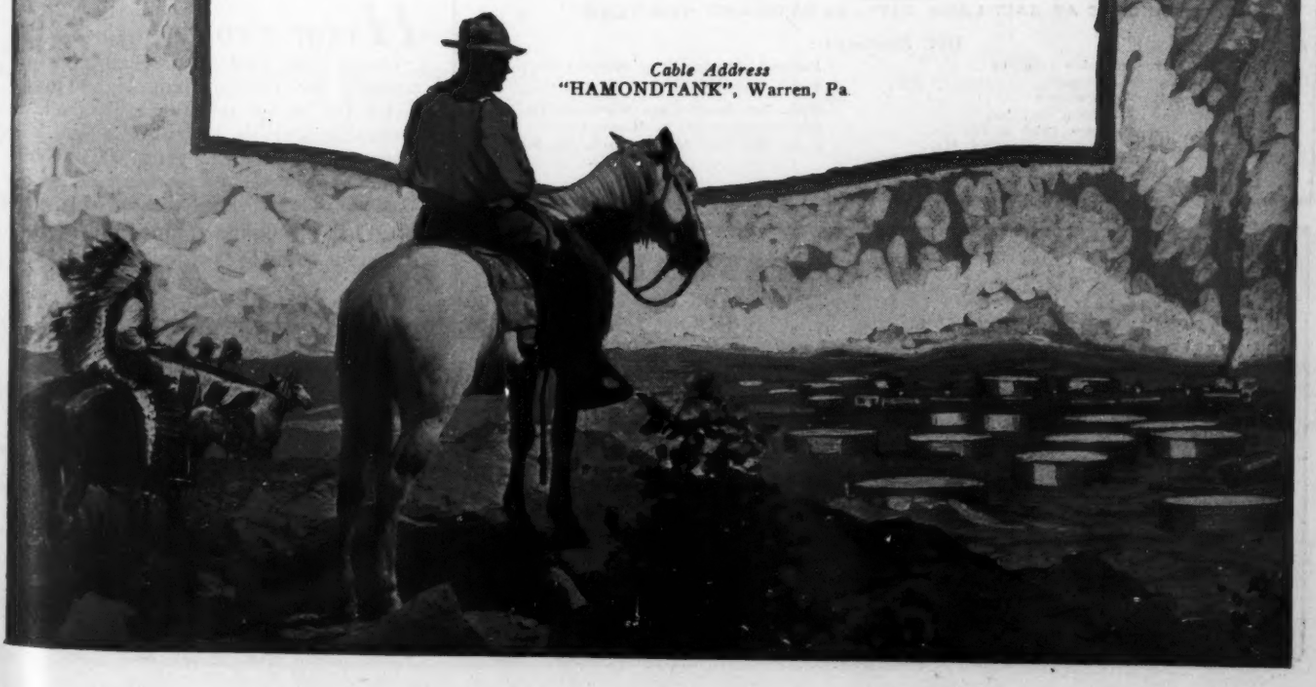

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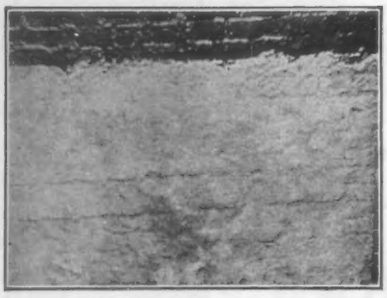

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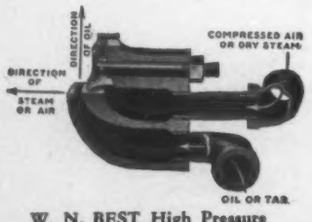

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The Month in Review

tankage at tide water. The original construction of this section was of lap weld pipe with screw joints. By reason of this fact, age of line and adapting it to gasoline transportation service, decision was made to weld all collars to pipe to assure the non-escape of this volatile product.

The initial combined line capacity in pumping from Belridge to Monterey is 5000 barrels per day, and will be handled by one pumping plant located in the Belridge area. Later it is proposed to double the capacity by the installation of a booster plant near Coalinga.

Actual laying and welding of pipe, as well as reconstruction commenced early in February and will be rushed to completion. Depending upon weather, the anticipated time for completion is estimated at between 60 and 90 days.

The new line will handle production of Associated Oil Company at Kettleman Hills and Belridge, and the production of Reward Oil Company, a subsidiary, which is now drilling at Belridge.

F. A. PIELSTICKER, vice president of Skelly Oil Company in charge of refining, died January 13 in Redlands, California, where he had gone for medical treatment, after several months of failing health.

Mr. Pielsticker was a former president of the Western Petroleum Refiners Association and had been one of the outstanding men of refining circles. He was interested in Midland Refining Company, which became a part of Skelly Oil Company, and was connected with the latter company until his death.

HUGH UPDIKE, operator in Osage field, Eastern Wyoming, has announced the plan of himself and associates for an oil refinery to be built in some Black Hills city this year. The plant would cost about $1,000,000 and would supply the market in South Dakota and Nebraska with products refined from Osage field crude. The scheme is to be backed by Oregon capital.

FOR the first time since its general reconsideration of all rules adopted by industries at trade practice conferences held in the last few years, the Federal Trade Commission February 3, announced its action on rules adopted by the petroleum and petroleum products industry, leaving but three of an original 21 rules in force, and these three are Group 1 rules enforcable by law. All rules embodied in Group 2, which represented merely the expression of the industry, and are not covered by law, have been rejected.